INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) SKILLS AND COMPETENCIES AMONG FACULTY MEMBERS OF MIZORAM UNIVERSITY AND NORTH EASTERN HILL UNIVERSITY IN USING E- RESOURCES: A STUDY

By

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Submitted

In partial fulfilment of the requirement of the Degree of Doctor of Philosophy in Library and Information Science of Mizoram University, Aizawl.

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CERTIFICATE

This is to certify that the thesis entitled **'INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) SKILLS AND COMPETENCIES AMONG FACULTY MEMBERS OF MIZORAM UNIVERSITY AND NORTH EASTERN HILL UNIVERSITY IN USING E- RESOURCES: A STUDY'** submitted by **OLIVER LALTHLENGLIANA** for the award of the Degree of Doctor of Philosophy in Library and Information Science is carried out under my supervision and incorporates the students bona-fide research and this has not been submitted for award of any degree in this or any other university or institute of learning.

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DECLARATION

MIZORAM UNIVERSITY
MAY, 2024

I **Oliver Lalthlengliana**, hereby declare that the subject matter of this thesis is the record of work done by me, that the contents of this thesis did not form basis of the award of any previous degree to me or to the best of my knowledge to anybody else, and that the thesis has not been submitted by me for any research degree in any other University/ Institute.

This is being submitted to the Mizoram University for the degree of Doctor of Philosophy in Library & Information Science.

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Place: Tanhril, Aizawl (OLIVER LALTHLENGLIANA)

Date:

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LIST OF ABBREVIATIONS

NEHU	North Eastern Hill University
MZU	Mizoram University
ICT	Information Communication Technology
CD	Compact Disk
DVD	Digital Versatile Disk
CAGs	Canada Association for Graduate Students
LMIS	Labour Market Information System
INFLIBNET	Information and Library Network
INDEST	Indian National Digital Library in Science and Technology
OPAC	Online Public Access Catalogue
OCR	Optical Character Recognition
ADF	Automatic Document Feeder
CIS	Contact Image Sensor
CCD	Charged Couple Device
SMR	Shingled Magnetic Recording
DOAJ	Directory of Open Access Journal
DOAR	Directory of Open Access Repository
PMC	Pub Med Central
SIAM	Society for Industrial and Applied Mathematics
PDF	Portable Document Format
OUP	Oxford University Press
LISA	Library and Information Abstracts
IEL	IEEE/IET Electronic Library
NPTEL	National Programme on Technology Enhanced Learning
NDL	National Digital Library of India
HTML	Hyper Text Markup Language

CHAPTER 1

INTRODUCTION

1.1 Introduction:

Information has become the backbone of modern society. Societies which acknowledge the importance of information experiences massive leap in their path to development, but those which does not realized the importance of information are lagging. Information has gained priorities in the global context which ultimately leads to increase of information at an overwhelming pace and the vis-a-vis growing information stresses for better dissemination and more efficient information service and management.

Libraries are the gateway to information through its various services and activities it delivers information to its users (IFLA, 1994). Regardless of their type libraries are becoming more important year by year. National libraries are important to uphold the knowledge integrity of a nation, they are a vital centre for the preservation of both the tangible and intangible heritage of a country, there are several texts that exist in the most primitive form such as, inscriptions in clay tablets, writings on leaves and tree barks, and it is the national libraries which initiate primary responsibilities to preserve these valuably old writings and further digitized them. Public libraries' inclusive service opened wide doors for learners to quench their thirst for information. Public libraries also provide space for continuing education and lifelong learning (Haggstorm 2004). Academic libraries gratify the scholastic impulse of modern society; it enhances research programs and leads the path of mankind's venture in the vast universe of knowledge. The prime objective of libraries at any level is to facilitate the information need of its users.

Jamil (2013) stated that, "Libraries are one of the important resources, if not the most important, in securing maximum from a well-designed academic program". Library resources are pragmatic in facilitating the users for academic development. It provides a viable platform for enriching knowledge to the students in general and teachers in particular. Libraries have served both students and teachers by collecting, storing and disseminating vital information through resources like books, journals, maps, micro-films,

microfiche, Audio-Visual recordings etc. These resources are available to assist the students in their academic career and the teachers in improving their professional skill. Libraries offer several services to fulfil the information need of its users.

Modern technology introduced many changes in library resources and services. Libraries no longer account to traditional resources but it acquired such resources which are acquainted with modern technology. The service provided by libraries is also changing in many aspects and ICT is the driving force. In order to cope with these changes the user must possess skills which will enable them to retrieve information of their choice from the complex mechanism of the library.

1.2 Libraries in the ICT Era: A Conceptual Approach

ICT is an abbreviation for Information Communication Technology, according to Techopedia (an internet source) "Information and communications technology (ICT) refers to all the technology used to handle telecommunications, broadcast media, intelligent building management systems, audio-visual processing and transmission systems, and network-based control and monitoring functions." Devi and Devi (2009) claimed that due to developments in ICT (Information Communication Technology) very drastic change are observed in the social life of the people. This change and development takes place in a continuous process in which information has been playing a vital role as an agent for change.

Libraries undergo prolific change due to the advancement of ICT. This paradigm change has fully transformed the image of libraries as libraries are no longer considered building used for conserving the books but libraries have not become information centres accessible anywhere at any time (Garg, 2013). This change can be witness in both its service and collection. Traditional libraries were confined to printed books, journals, periodicals and increased in library collection urges increase and library space and workforce. In the ICT era computer and telecommunication technology facilitates enhanced library

service. Human efforts engaged in the in-house operations of libraries have been reduced through automation process, and digitised collection consumed less space. Sameni and Mehbaz-ul-Islam (2003) framed that, "computerization of library housekeeping operations, predominantly by computerization is known as library automation." Implications of ICT do not pertain only to library in-house operations rather there are many changes in the library collection relating to emerging modern technology.

1.3 E-Resources: An Overview

Ashikuzzaman (2018) defined e-resources as a resource which require computer access or any electronic product that delivers a collection of data, be it text referring to full text bases, electronic journals, image collections, other multimedia products and numerical, graphical or time based. E-resources have gained much importance in the prevailing digital era. In most simple words, when we process data and convert it into meaningful and useful form it becomes information, when this information is fetched in electronic form; it is called electronic resources (Bala and Vishwakarma, 2014). Features like remote access; less consumption of library space, multiple access ability, etc. is giving e-resources a stronger foothold in the modern library scenario. Electronic resources are the bedrock of provision of accurate and timely information for better educational outcomes. They aid in the retrieval of huge amount of information for teaching, learning and research. Owing to information explosion and the emergence of new technologies, information needed by students are now, mostly found in electronic resources in university libraries, Information communication technology centers and computer laboratories (Ekenna and Iyabu 2013). Ashikuzzaman (2018) further identify the various types of e-resources as follows:

1. E-journal: E-journals are electronic version of journals. It can be read by using desktop computer or other suitable electronic device without physically present in the library premises. Articles in e-journals can be shared by using online communication facilities as well as download

and print as per the journal policy. Articles in e-journals can contain hypertext which can navigate the reader to another relevant literature or source of information.

2. E-books: E-books are electronic format of books which can be read on suitable electronic device other than print version. Further, e-books are compilation of files into one unit which can be access through electronic devices.

3. Online databases: There are several databases which is stored locally on an individual computer on the other hand there are databases which are stored on a remote server and can be accessed through internet and these are called online database.

4. Websites: Website is simply a collection of related webpage which is maintained by individual or organizations. Webpage in websites are not merely related by also interlinked and they all come under a common domain.

5. CD or DVD: CD and DVD are two optical disk used as storage device. An important feature of CD and DVD is that they store data using light. CD is mostly used for storing audio files while DVD can store all types of multimedia files.

Bala and Vishwakarma (2014) based on its characteristics divided e-resources into two types:

1. **Static e-resources:** They contain fixed information and never change form e.g. Databases available in C.D. form.
2. **Dynamic e- resources:** Such documents also contain fixed information but this information can change its outward form e.g. Multimedia C.D. ROM.

1.4 Skills and Competencies: A Definitive Approach

According to the Miriam Webster Online Dictionary, the term Skills mean the ability to use ones knowledge effectively and readily in execution and

performance or dexterity or coordination especially in the execution of learned physical task. The Computer Era has developed certain new ways to execute variety of tasks, several traditional techniques which have been altered by the arrival of ICT. It is generally agreed that one must developed certain skills to complete his objective and at the same time such skills must be rejuvenated and improved prior to the changing environment.

According to the Canadian Association for Graduate Students (CAGS, 2008**)** professional skills is, "behaviors that can be learned, that can be improved with practice, that require reflection, and that benefit from on-going coaching." From the following definition framed by the Canadian Association for Graduate Students (CAGS) it is obvious that the concept of Professional Skills includes the attainment of such skills and improvement of the same through life experience and through various modes of education.

The scope of Professional skill development is very vast. There are countless varieties of occupation in the world which demands for predefined skills and such skills can be developed and improved through training and experience gained by continuous practice. Imparting Professional Skills Development has been prioritized by nations around the globe. In India the National Skill Development Mission was launched on 15thJuly 2015 by the Ministry of Skill Development and Entrepreneurship. This Mission aims at creating and implementing national framework for skill development, ensure sufficient high quality options for long term skilling, establishing high quality teacher training institutions, focused outreach programs on skill development activities among the disadvantage section of the society, create national database known as Labour Market Information System (LMIS) and provide the citizens with vital skill development initiatives.

Skill Development does not pertain to entrepreneurship alone in fact it encompasses every such activity which required specified skills. Skill development has become increasing within the teaching domain. The modern teacher must be flexible to the changes that occur around him. Information

Communication Technologies have provided several new opportunities to locate and retrieve information which can be used to improve the teaching career. Skill development is also very important for researchers at all levels. Research requires several skills for collection of data, retrieval of literature, tabulation of data, etc. Skill development enhanced the research capability as well as the quality.

1.5 Developing skills and competencies in using e-resources

Prevalence of e-resources in the library reflected on the user community. The technique of location and retrieval of e-resources differs from that of the traditional technique. In order to make prolific use of e-resources one must be acquainted to certain skills such as computer skills, internet skills, media skills, etc. Information retrieval skills are crucial for retrieving information in this era of technology that most of the information needed for research can be retrieved from electronic sources. Therefore knowledge of skills is necessary to selectively retrieve accurate, relevant and up-to-date information stored in document instead of all the information (Ekenna and Iyabo, 2013). To locate the desired e-resources one has to browse through the internet. In this regard it is very important to have some knowledge about various search engines, and search techniques. E-resources cannot be snatched out of the shelf like any traditional printed documents it needs to be saved or downloaded and it is important for users of modern libraries to possess these skills. Storage of e-resources demands knowledge on storage devices such as pen drive, hard disk, diskettes, etc. As such, optimum utilization of e-resources demands for lifelong learning in one way or the other. The technology is changing fast and it is impossible to predict what lay in store ahead but it is most ideal to update our skills in handling e-resources and remain competent in the long run.

1.6 Mizoram University and North-Eastern Hills University: A Brief Profile

North Eastern Hill University (NEHU) and Mizoram University

(MZU) are two prominent universities located in the northeastern region of India. While they share the common goal of providing quality education and fostering research, they have distinct histories, locations, and areas of expertise. NEHU and MZU are Central Universities in the northeastern region of India. While they share common goals related to education, research, and community engagement, they each have a unique focus and areas of expertise. NEHU, with multiple campuses, is known for its interdisciplinary research and a broader regional reach, while Mizoram University plays a significant role in preserving and promoting the culture and languages of Mizoram, where it is based.

Table-1.1: Faculty position of MZU & NEHU

Sl. No	**Name of University**	**Sanctioned Strength**	**Existing Strength**
1	NEHU	467	310
2	MZU	314	237
	Total	**781**	**547**

Source: AQAR of NEHU & MZU, 2019-20

1.6.1 North-Eastern Hill University (NEHU)

North Eastern Hill University, commonly known as NEHU, stands as a beacon of higher education in India's north eastern region. Nestled in the picturesque hills of Shillong, Meghalaya, NEHU has been providing a platform for academic excellence and research in the north eastern states for decades.

NEHU's main campus is situated in Shillong, often referred to as the "Scotland of the East" for its stunning landscapes and pleasant climate. The serene and lush surroundings provide an ideal setting for learning, research, and personal growth.

NEHU boasts a wide range of academic programs, catering to various fields of study. The university offers undergraduate, postgraduate, and doctoral programs in arts, science, commerce, management, law, engineering, and

more. The diverse range of courses attracts students from all over India and even abroad.

The university is renowned for its focus on interdisciplinary research. NEHU encourages collaboration between different departments and research centres, fostering innovation and the development of new knowledge. This approach has led to significant contributions in fields such as environmental science, anthropology, and cultural studies. Moreover, NEHU has consistently ranked among the top universities in India, and its faculty members have earned national and international recognition for their research contributions. The commitment to academic excellence is evident in its rigorous curriculum and state-of-the-art facilities.

Image 1: North Eastern Hill University (NEHU)

North-Eastern Hill University (NEHU) was established by an act of Parliament on 19th July 1973. Previously the university functioned in the rented buildings at Shillong and in due to certain Government initiatives sites for the university was acquired at Umshing, on the outskirt of the state capital.

According to the NEHU Annual Report (2020) The University has eight schools, viz. School of Economics, Management, and Information Sciences (SEMIS), School of Education (SE), School of Humanities (SH),

School of Human and Environmental Sciences (SHES), School of Life Sciences (SLS), School of Physical Sciences (SPS), School of Social Sciences (SSS) and School of Technology (SoT). The University has 44 academic Departments and one centre of studies, while 35 Departments and 01 centre of studies are located in Shillong campus, nine academic Departments are located in Tura campus. NEHU, a premier University of the region, attracts students from different parts of the country and from abroad. Students are admitted to different programmes in various schools according to the University Rules and UGC guidelines. The University has adopted the Choice Based Credit System (CBCS) for PG courses and is all set to introduce it at the UG level as well. During 2019–20, 5007 students were enrolled in degree/diploma/certificate programmes in various Departments of the University. Of them, 16 students are from Asian and African countries.

1.6.2 Mizoram University (MZU)

Mizoram University (2022, November 3) describe that Mizoram University was created by an Act of Parliament (No. 8 of 2000) and it became functional from 2nd July, 2001. The University is located at Aizawl, the capital city of Mizoram and is spread over 978.1988 acres in an area on the outskirts of the city. Prior to the existence of Mizoram University, the North-Eastern Hill University (NEHU) with headquarters at Shillong was operating a campus in Mizoram. Headed by a Pro-Vice Chancellor, the then Mizoram Campus of NEHU consisted of seven Post-Graduate Departments, namely, Economics, Education, English, Forestry, Mizo, Psychology and Public Administration. During the last 22 years of its existence, Mizoram University has made considerable progress in terms of infrastructure, academic programmes, and man-power and support services. The University provides facilities for Disabled and Visually Challenged students and staff. All buildings in the University Campus have ramps for wheelchairs; disabled-friendly washrooms are also available in the hostels. Mizoram University was accredited ‘A’ grade by NAAC in 2014 and 2019. It was also awarded ISO Certification in 2018.

The University was ranked as one of the top 100 Universities in India, assessed by the NIRF rankings from 2016 to 2023 under MHRD. In the Times Higher Education Impact Rankings 2022, Mizoram University secured 1st Rank in North-East Region of India. Mizoram University ranked 1st among the central universities of the North East region by bagging the 13th position in the Indian Institutional Ranking Framework (IIRF) 2023's Top 20 Central Universities category. The University has 40 affiliated colleges and one constituent college. The University is one of the pioneering Universities in the country which has successfully implemented the Choice Based Credit System (CBCS) since 2013. In line with the NEP 2020, Mizoram University is progressing towards offering programmes that envisage broad-based, multi-disciplinary and holistic education at various levels of UG and PG Programmes.

Image 2: Mizoram University (MZU)

Faculty and students play an active role in extension activities like the Red Ribbon Club, Techno Club, NSS and SPIC MACAY- Heritage Club. Several members of the faculty and students are also actively involved in social services, some of which are curriculum stipulated. The University from its inception encourages its students to take part in Sports and Cultural Activities. The University has a Sports department with different coaches.

AQAR of MZU (2020) states that the Mizoram University has 9 Schools under different disciplines and 38 Academic Departments. All departments have student intake at the undergraduate/postgraduate levels. Mentoring is conducted in an extremely significant manner across all departments. A total of 2432 students are enrolled across different academic departments of MZU.

1.7 Review of Literature

Numerous literatures have been published in this area of study. The scholars have reviewed the following literatures which are found related and accountable to give insight to the present study:

Pawinun and Asundi (2002) investigated library instruction programs made available in Universities of Thailand. The paper declares several methods which can be used to impart information literacy among university students and emphasize the need for skills in locating and retrieving information from web-based services.

Gibson, et.al (2007) intended to frame the convergence and divergence of Information Literacy and IT Fluency and concluded that Information fluency is perhaps the optimal provisional concept for the academic library's educational mission, one that builds upon the ordered universe of knowledge and skill envisioned in the Information Literacy Competency Standards, but with technology-mediated abilities and capacities infused in a dynamic, situational way. The very unpredictability of the technology environment suggests that the fluency paradigm better addresses the need to conceive of the student as an active agent in his or her own learning. Defining, accessing, evaluating, and managing information, comprising a form of research education, is the classic skill set for information literacy. The blended learning available through infusing technology into this skill set repositions information literacy as a force for more pervasive, creative impact educational multiplier effect, both within the formal curriculum and more generally, throughout students' lives. Information literacy and IT fluency, as educational initiatives,

pose large challenges for librarians, academic computing professionals, faculty, administrators, and students. The integration of learning and student experience demands a new approach to programmatic integration as well. The existing nomenclature confusion may persist but will, in time, be resolved in favour of integrative concepts and collaborations at all levels of education.

Shooken (2009) in his paper laid stress to the importance of web portal in accessing information in the ICT era. It demands LIS professionals around the world to realize the importance of web portals and enhance education in effectively using the web portals. Julie (2009) studied the levels of information literacy among the users of Pachhunga University College Library and Hrangbana College library, Aizawl. This study also tends to measure the degree of efforts put by the library professionals of both college libraries towards imparting information literacy to the users. This study came to highlight the importance of making internet available to the students to enhance information literacy. Users are not well trained to become information literate meanwhile Library Orientation Program is conducted in both the colleges.

Santhi et al. (2010) investigates the relationship between computer literacy of Academic Staff and their use of electronic information sources in affiliated engineering colleges Coimbatore Anna University at Karur District of Tamil Nadu. . The impact of other factors such as age, gender and educational background on the use of electronic information sources is also investigated. A statistically significant relationship is found between computer literacy and the use of electronic information sources and services. A significant relationship is noted between the age of academics and their use of electronic information sources.

Jimoyiannis (2011) in their research intended to shed light into adult digital literacy using learners' and educators' experiences and perceptions at Second Chance Schools, a project in Greece aiming at combating social exclusion through education. In exploring the above, this investigation uses a

case-study approach within a qualitative paradigm and draws upon a heuristic that brings together a set of ideas on adult program development to guide research techniques and analysis procedures. The latter focuses on five key elements of program development for adults: needs identification, planning, design, climate, and evaluation and the results of the study emphasized that adult learners comprise a population with special characteristics and traits regarding digital literacy and related learning activities. There are still a lot of parameters to be identified regarding the way adult learners perceive digital literacy, their practices or difficulties when using computers, and appropriate ways for educators to support and encourage adults when learning about and with ICT. Further research is necessary to address the issues above in order to redirect future policies and strategies for adult digital literacy and ICT integration in the SCS. Golwal (2011) studied the Information Literacy levels of students, scholars and faculty members of Dr. Babasaheb Ambedkar Marathwada University in Aurangabad. This study incorporated 312 respondents and a larger section of them are found to be using internet and its allied service in to enhance their academic career and are also comfortable in using the same.

Anyoku (2012) examines the computer skills of Librarians in Nigeria. The result of the study shows improvement over the previous study. Computer literacy for the various facets of computer and software use ranges from 60% to 98% literacy levels. Despite the improvement there is a need to ensure that every librarian in the country is equipped with suitable ICT facilities and possess the skill to handle them and a handsome amount of them are using Google search-engine to access e-resources. Seema (2012) elaborated the need for enhancing technological skill of library professionals in order to promote information dissemination in the ICT era. It highlighted the core competencies required in a technological librarianship. Bembem, Devi and Singh Gross and Latham (2012) studied the proficiency level of First Year students in two community colleges. It is found that most of the students are under below-proficiency level and no students can scored in the advance range. Claro et al.

(2012) evaluates fifteen-year-old Chilean students Information and Communication Technology (ICT) skills. The paper presents an operational definition of ICT skills, an instrument measuring these skills as well as the students' results in the test. The definition of ICT skills used considers Chile's curricular framework, functional and cognitive skills. Specifically, ICT skills were defined as the capacity to solve problems of information, communication and knowledge in digital environments. A performance-based assessment was designed in a virtual environment to measure these skills. The analysis of the results showed that the majority of students were able to solve tasks related to the use of information as consumers, i.e., approximately three quarters of the students were able to search for information and half of them were also able to organize and manage digital information. Additionally, they show that very few students were able to succeed in tasks related to the use of information as producers, i.e., only one third of the students were able to develop their own ideas in a digital environment and less than one fifth were able to refine digital information and create a representation in a digital environment. Socioeconomic group, access, daily use and confidence in doing ICT-related activities were all positively associated with higher scores, showing the need to implement strategies to compensate this inequality, possibly by explicitly defining these aims in the national curriculum. Hismanoglu (2012) investigate the perceptions of prospective EFL teachers in the distance higher education system toward ICT implementation in teaching English as a foreign language. The majority of respondents who expressed negative attitudes to ICT integration found the nature, level and delivery of the training inadequate and accordingly affirmed that they do not feel sufficiently competent to use ICT in their future subject teaching without having sufficient prior knowledge of ICT dissemination. The results of the study imply that training that will enable teachers to become competent in and receptive to ICT is quite critical in distance education realms.

Wijitunge and Manatunge (2014) reviewed the information literacy programs offered for law students in Sri Lanka which indicates that both

positive and negative result can be drawn from the past experience. It is significantly found that efficient faculties IL courses with ideal teachers and supportive administration is not enough to successfully impart IL among the students, the main drawback is that the students are not participating well.

Santharooban and Premadasa (2015) undertook a rigorous study with a view to devise IL Model for Problem Based Learning (PBL). The PBL processes were divided into 4 phases. In every phases of PBL the requirement of IL skills are highlighted. This study concludes that Information Literacy can be a driving force to enhance Problem Based Learning. This study was based among the faculties of Health Care Science of Eastern Universities, Sri Lanka. Sujatha (2015) investigate the use of Electronic Information Sources (EIS) by the academic community (teachers/scientists, researchers and postgraduate students) of the Fisheries Colleges/Research Institutes in South India. The prime objective is to find out the use of different types of EIS, analyze the use of EIS in relation to other information sources and how they perceive the advantages of e-sources and problems for accessing them. Study results show that the academic community who participated in this survey are aware of e-sources and also the internet. Even though a majority of the academic community uses electronic information sources for their academic-related work, the most preferred information source by the respondents is the printed journals followed by EIS as the next preferred source. It is also observed that 'Retrieval of irrelevant information', 'Poor connectivity or slow access' and 'Poor database searching skills' are the major problems identified by the respondents in the use of electronic sources. Sinha (2015) study the ICT and internet literacy for accessing e-resources available under UCG INFONET digital consortium and finds that the development of adequate ICT infrastructure in Indian colleges and universities is still urgently needed, and faculty, research scholars, and students must participate in ICT awareness training sessions offered by a variety of organizations, including the ICSSR, UGC-Academic Staff Colleges, INFLIBNET Centers, numerous professional organizations/societies, college/university libraries, and computer centers. For

academic and research purposes, library users at various universities and institutions in the North Eastern Region should make use of the scholarly e-journals and online databases made available by the UGC-INFONET E-Journals and Digital Library Consortium/ and other Consortia like INDEST.

Deepamala and Shivraj (2016) analyzes the information literacy skills which include identification of required information and locating needed information, evaluating retrieval information on the basis of reliability and validity, disseminating retrieved knowledge and their presentation on preferred communication media among the women faculty members belongs to the Department of Science & Humanities in Engineering colleges at Coimbatore, Tamil Nadu. The study was assessed based on primary data of the respondents through a structured questionnaire. The questionnaire was distributed among women faculty members of Science & Humanities Department in Engineering Colleges in Coimbatore. The filled in questionnaire were received from the women faculty members working in 27 Engineering colleges in the south region of Coimbatore District. Out of one hundred and ten questionnaire distributed, 96 duly filled responses had been received. This study is limited to the women faculty members working in the south region of Coimbatore district only. It is concluded from this study that the women faculties belong to the Department of Science & Humanities in engineering colleges of Coimbatore South Region prefer internet and online sources including social media as the source of information. They are also learning and sharing the current knowledge and developments through social media. From this study it is observed that the respondent's information requirements towards Teaching & Research and interpretation level are good and they disseminate the knowledge to the student's community effectively. Dulle and Alphonce (2016) study the levels of awareness about LibHub among research scholars at the Sokoine Agriculture University. This study indicates that conducting information literacy training promote use of e-resources and accessing the same through LibHub. Majority of the respondents are aware. This study evident that keyword search strategies is the most frequently used search strategies and CIT 300 subscribers are more

advance in searching online information than the non- subscribers. Singh (2016) studies the extent of usage of internet at four women colleges in Jalandhar. It is found that the institutions must strive to increase the number of computers to enhance the skills of the students in using the internet. This study also highlights the need for development of wifi facilities in the institutions as libraries are changing from print resources to e-resources. Bilawar and Puja (2016) study the impact of e-information literacy skills on the information seeking behavior of university teachers. Devi and Devi (2016) studied the usage of e-resources among students of School of Humanities at Manipur University. The survey was intended to identify the awareness level of using ICT facilities by students to support their scholastic career and identify the problems faced by the students while accessing e- resources. It is found that most of the students are aware of e-resources. The study reveals that skill in handling electronic information largely affected the reading habits of University teachers by promoting the use of e-resources.

Suman and Sanjeev (2017) conducted a study with an attempt to know the IL skills of the faculty and students of Postgraduate Institute of Medical Education and Research, Chandigarh and Pt. B.D. Sharma University of Health Science, Rohtak. The study was based on the data collected through questionnaires. All the respondents were able to specify their information needs. A majority of the faculty and students rated their skills high in accessing information in print and electronic format. For evaluating information in print format most of the respondents rated their skills very high whereas in electronic format most of them rated their average skills. In comparison to students, the faculty members of both the medical colleges were more familiar with the bibliography. A very small percent of the respondents of both the medical colleges were familiar with the Boolean operator OR. Hkawng (2017) studied the impact of information literacy upon the reading habits of students at theological colleges in Kachin Theological College and Eastern Theological College of Jorhat. This study reveals that printed documents remain an integral part of information sources but its electronic counterpart is gaining a

significant importance. The Information Literacy Resources Package (ILRP) played key role in enhancing information literacy among the respondents. Manec and Sebjan (2017) measures the impact of information literacy programs among the undergraduate students of Slovenia and it is found that much improvement can be witnessed as a results of the information literacy programs. Analysis of the collected data show significant increase in the Information literacy after the completion of Information Literacy program which is relatively low at the initial stage. DeBose et.al (2017) studies the problems of imparting information literacy skills in the College of Agriculture and Life Science Community at Virginia Tech. It is found that Librarians at CALS made strong effort to impart information inquiry skills throughout all programs under CALS. They also offer additional instruction for the same course. Bansal and Kumar (2017) perform a case study upon the use of OPAC at Guru Angad Dev Veterinary and Animal Sciences University (GADVASU) Library. This study lay stress upon the degree of usage of the OPAC, search strategies adopted by the user and satisfactory level of the user. It is found that majority of the user use the OPAC facilities and it is most frequently used to find a book. Majority of the users use the Title value to search their desired documents.

Wu, et.al (2018) undertake research with an aim to develop an explanatory model for the information and communication technology (ICT) competencies of students with and without learning disabilities (LD). A conceptual model was proposed, and included five major constructs such as attitude towards using ICT, ICT competency, demographic characteristics, ICT access, and purpose for using ICT. A self-reported questionnaire, Scale of Digital Participation (SDP), was designed by the authors and used to collect data. Data from 117 elementary school students with LD and 117 without LD were used to test the initial model. Meanwhile, data from 102 junior high school students with LD and 102 students without LD were used to evaluate the cross-validation of the revised model. The results of structural equation modelling (SEM) demonstrate acceptable goodness of fit for the initial ICT

competency model but poor parsimony. Therefore, a revised ICT competency model with both parsimony and goodness of fit was generated using data from elementary school age students. Moreover, this new model was also able to further explain the complex phenomena of ICT competency for junior high school age students. Nevertheless, no differences were found between the elementary school and junior high school models, thereby confirming the cross-validation of the revised model.

Khuongtruong (2018) measure the basic ICT skills of Canadian immigrants and non-immigrants to document differences in skill levels, and those skills' relationship with labour market earnings, across immigration classes and categories of Canadians at birth. Adult immigrants, including those assessed by Canada's points system, have lower average ICT scores than Canadians at birth, although the rate of return to ICT skills is not statistically different between them. Immigrants who arrive as children and the Canadian-born children of immigrants have similar outcomes as the Canadian-born children of Canadian-born parents. Oyedukun et.al (2018) use a descriptive survey design using a quantitative research approach was used to evaluate the ICT proficiency of library personnel at selected universities in Kwara state, with a sample size of 122 taken from a population of 91. One hundred and nine participants— representing an 89.3% return rate—completed and returned the survey, which was used as the data gathering tool. The results showed that library employees at a few university libraries, including those at the Universities of Ilorin, Kwara State, and Al- Hikmah, had a high level of ICT proficiency, particularly in the areas of basic and intermediate ICT competency. According to the study's findings, the librarians at such universities are able to use ICT technologies efficiently for library operations. They named library schools, computer training facilities, workshops, seminars, private instruction, watching YouTube tutorials, and advice from friends and family as places where library staff can pick up ICT skills, but they placed more emphasis on having additional computer science degrees. A limited work schedule, a lack of desire, a lack of experience, poor training, and an improper

library and information science curriculum have all been recognized as barriers to ICT skill acquisition. The following issues have been identified as obstacles to the effective use of ICT tools in the library for the provision of dynamic information services: a dearth of adequate information infrastructure; a lack of provisions for staff training and development; the library's limited and constrained budget; a lack of technological know-how; a staff member's fear of technology; and an epileptic power supply. The study advises library management to provide a suitable information infrastructure, as well as create provisions for staff development and training, in addition to the aforementioned obstacles and limits. The library's experienced personnel should also train any incoming or new hires. The curriculum in libraries should be revised, and one should be created that will take into account future developments in information and communication technology. Professional associations and regulatory bodies should organized regular seminars and workshops that will improve ICT skills of librarians. Finnie, et.al (2018) In their study they provides a conceptual framework for discussing information and communication technology (ICT) skills shortages in a context in which having a sufficient supply of skilled ICT workers both inside the ICT sector and more broadly and how it is critical to the performance of the Canadian economy. They started with an outline of a simple model of how ICT skills shortages might be manifested in labour market signals, such as rising wages, and then how, in response to these signals, workers already in the labour market should adjust, whereas young people making schooling and career decisions would be expected to skew toward ICT areas. The study then discuss some of the reasons these dynamics might not follow this model, and therefore how ICT skill shortages could potentially endure over time. This study sets the stage for the other articles in this special issue, which address these and other issues related to ICT skills from a mix of traditional academic and industry perspectives.

Saikia (2019) in her study of Awareness and Usage of Electronic Resources among Humanities and Social Sciences Research Scholars of Central Library, Tezpur University it is concluded that Information technology

plays a significant role in digital era. The technology affords a great impact on the services and resources of library. Traditional libraries have transformed into digital and virtual libraries. Print resources are also being digitised. The rapid growth of electronic resources has changed the scenario of university library collections. Every year all universities invest huge amount of budget to procure electronic resources for students so that it is very essential to investigate the awareness, utilisation of library electronic resources and related issues facing by patrons of the library. The finding of the study revealed that all respondents are aware of and use various types of electronic resources and the study recommended the improvement of high-speed Internet connectivity and subscription of more electronic resources for patrons.

Parmar and Pateria (2020) in their study entitled, "Digital information literacy competencies among pg students of CCS Haryana Agricultural University, Hisar: A study" gives an overview of information literacy skills among PG students of Chaudhary Charan Singh Haryana Agricultural University Hisar. It was found that from the study students were aware of laptops, smartphones, but the highest number of students was possessing laptops (92.54%), Smartphones (91.04%), and USB devices (91.04%). All the students were aware of the e-library catalogue followed by the e-journals including CeRA Journals (89.55%), and Krishikosh (86.57%). The majority of students (88.06%) learned IT skills from their friends.

Shukla et al. (2021) assess the digital information literacy skills among the library and information science students of the University of Delhi. The survey method has been found suitable to conduct the study in which a structured 80 questionnaires were distributed randomly among the students of DLIS and 72 (90%) of questionnaires were received from the respondents. After the analysis of the questionnaires, it has been found that the maximum 57 (79.17%) students were using a computer daily and they are familiar with MS office application software. All the students were well aware of Internet literacy skills and also they all are using the Internet in which the large number

i.e. 66 (91.67%) students were using it every day. The maximum 69 (65.71%) of students were using the Internet through their mobile data while a large number 69 (56.1%) of students using the simple searching technique. Oyeyemi Oluwatoyin (2021) investigate a rationale for postgraduate students' acquisition of digital literacy skills in 21st-century education. Digital literacy skills have penetrated all aspects of education to become the most important skills scholars seeking information for academic advancement must possess. The descriptive survey research design was adopted in the study that unravelled digital competencies and skills of the postgraduate students in accessing electronic databases in Ambrose Alli University, Nigeria. Copies of the questionnaire used for data collection were administered on 320 respondents that were accidentally sampled from five randomly selected Faculties from the 14 existing Faculties in the University. Out of the copies of the questionnaire distributed, 263 copies were retrieved given an 82.2% return rate. The study revealed that 171 (65.0%) and 168(63.9%) respondents with X = 2.3 and 2.0 respectively lacked personal abilities to determine and respond to security issues relating to web-based activities; and to construct search strategies for locating information in a digital environment.

Jyotsna and Madhu (2022) investigate about the actual aspect of digital literacy competency, comfort level of using computer applications, familiarity of Internet resources, sources for information retrieval, preference of search engine, awareness of mobile learning Apps, and application of Web 2.0 tools among library users of Rajendra Prasad Central Agriculture University, Nalanda University and Central University of Orissa to fulfil their academic performance. To accomplish research, systematic reviews and survey method was adopted with questionnaire as an important tool for smooth collection of data, where questionnaire in both online and offline mode was used to conduct present survey. It was distributed among library users to get various interesting responses related to digital literacy competency where it was found that most of the students are comfortable and aware of web tools for learning purpose and maximum users are familiar with social networking sites. E-textbooks are used

by 76.81% users of CUO on maximum for information retrieval and google is most preferred search engine with 100% response. Users are less aware of some mobile learning applications such as BoostHQ, Evernote etc. Pati and Pattanaik (2022) in their study of digital literacy and competencies among MLISC students of Sambalpur University and G.M. University, Odisha it was found that the academic circle have flourished to convert into partially digitized status. Along with the instructive environment, the patrons are also making themselves compatible with the same. Regrettably, they do not possess any other option. To participate in the swift, they need to get updated, especially, digitally educated. In this context, 'Digital Information Literacy' is a relatively fresh term, yet it is an integral component of Information Literacy. Digitally literate people can confidently utilize, manage, produce, quote, and share digital information sources. The way information is used, generated, and transmitted indicates an understanding of the subject. Information literacy includes a key component called digital information literacy. It includes strategies and procedures for gathering digital resources and assists users in dealing with information in a range of electronic formats. Literacy is traditionally assumed as the ability to read and write. The term's meaning has been expanded to include the ability to use language, information available from various sources in many formats, such as images, printed text, CD ROMs, Databases, and websites. Information literate one needs to know why information is needed, when information is a need, how to find information and how to use all of these sources and think critically about the available information.

Oladapo, et.al (2023) examined the digital literacy skills and use of electronic resources for job performance among lecturers in the University of Ilorin, Kwara State, Nigeria. The specific aim of the study is to provide a clear understanding of the digital literacy skills possessed by lecturers in enhancing their job performance within academic environment and beyond. The total population of study was 1504. The study adopted the descriptive research design. Random sampling technique was utilized to select a sample

of 168 respondents out of the total population of 1504 from the University of Ilorin in Kwara State. A structured questionnaire was developed and administered to all respondents and 83.3% of the questionnaires were returned and found to be valid for analysis. Data were analyzed using descriptive statistics. The findings revealed that Search Engines, E-mail and Websites were the most available and the most often used e-resources among lecturers. Lecturers have high digital literacy skills in using digital tools to solve real-life academic problems and initiating search strategies by using search languages and Boolean logic. Erratic power supply and slow Internet connection were the major challenges encountered in the use of e- resources. The study revealed that the higher the level of availability, the higher the frequency of use. Hence, the study concluded that there is need for institutional provision for the availability of more electronic resources and electricity or alternative as the digital tools cannot function without electricity.

Yadav and Sharma (2023) assess the proficiency of research scholars in using digital tools, resource access, content, and their level of digital literacy. Data from research scholars were collected through a structured questionnaire using a simple random survey method. A total of 120 questionnaires were distributed to the research scholars of Maharshi Dayanand University, Rohtak, out of which 83 were completed and received back with a response rate of (69%). The result of the study shows that most respondents are aware of e-resources used by respondents' i.e. ebooks, e-journals, e-thesis/dissertations, and e-magazines. The study also indicated that a large number of respondents are using databases like Google Scholar, Scopus, Taylor & Francis, Web of Science, Economic & Political Weekly, Oxford University Press, Science Direct, JSTOR, Springer Link, and Emerald Insight. According to the study majority of respondents i.e. 28(16.28%) said that digital literacy programmes organized by the library help in improving their ICT skills helps a lot in their study and also makes them aware of the quality, accuracy, reliability, credibility, and authenticity of digital information available online.

1.8 Research Gap:

From the above literature it has been found that paradigm shift in the nature of libraries at different level has evoked strong priority towards using e-resources among the intellectual community. On the other hand non-conventional resources cannot be ruled out easily this is due to lack of skills among the general society, scarcity of funds, lack ICT facilities, etc. Numerous studies have been under taken to identify the extent of usage of e-resources by students, researchers and faculty members as well as the inclination of libraries to provide users with abundant e- resources.

Both universities taken for study have several initiatives to improve their e- resources collection but at the same time imparting user education as well as the user personal tendency to be acquainted with e-resources and its allied facilities is also important. The present study is proposed to unveil the intensity of both parties (library and user) to cope with the changing library scenario in the ICT era.

The scholar apart from the above has referred more than 20 literatures comprising various journal articles, conference proceedings, e-resources etc. in the present field of the study and the process is still going on to find adequate number of resources. From the foregoing literatures, it could be found that, no work in the present research problem has yet been undertaken by any of the scholars and hence, the present work will bridge the gap.

1.9 Significance and Scope of the Study

In view of the prevailing of ICT in library services, the resources are available to the users in a virtual mode. Accessing to the same and getting link to the other resources have become paramount especially for the faculties to enhance their knowledge horizon in teaching and research. Therefore, skills and competencies are indispensable among the faculties to access and in the process to maximise the use of electronic resources. Its importance has been well recognised among the elite groups for its instant, authentic and scalable

information for adding positive dimensions to excel the teaching, learning and research purposes. To add value to the learning environment, the libraries are making all out efforts to make gaining the library resources using technology to all the users' communities. Mizoram University was the extended campus of NEHU known as 'NEHU Mizoram Campus' which, however, is functioning as a separate status since 2000. Further, till today many academic as well as administrative practices remain common in both the Universities. Again, in terms of NIRF ranking and NAAC accreditation, NEHU is having higher grade in comparison to MZU. In this remark, it is very important to understand the levels of technological skills possessed by faculty members of both universities focussing primarily in use of library resources to draw a reliable conclusion.

The present study, though, imminent in all higher education is however, limited to the faculties of two central universities i.e., Mizoram University and North-Eastern Hill University of. Further study will be carried out to identify the availability of e-resources in both the university central library.

1.10 Research Design

Research design is a crucial component of the research process. It refers to the overall strategy or blueprint that guides a researcher in conducting their study. A well-structured research design helps ensure that the study is systematic, well-organized, and capable of addressing the research questions or objectives effectively.

A well-constructed research design is essential for the success of any research project. It helps ensure that the study is structured, logical, and capable of providing valuable insights into the research questions or objectives.

1.10.1 Statement of the Problem

Elsevier Author Service (2023, March 21) defines that "Statement of the Problem" as a critical component of research that serves as a concise and

clear description of the issues, challenges, or gaps in knowledge that the research aims to address. It provides the context for the research and highlights the significance of the study. Writing a well-defined problem statement is the first step in conducting meaningful research.

The surplus of information available both print and electronic forms, especially through the internet in public domain in the form of subject gate ways, e-books, e- journals, subject and subject concept-based pages etc. as well as the information available through different subscription-based database made available by most host and aggregators play a significant role in teaching, learning and research. Keeping in view, the huge amount of information resources available, library and information science professionals exercise their expertise in managing the resources in a scientific way using the technology and provide access to the same through Internet and Intranet domain so as to maximise its use. In this perspective, it is very important to find out the comfort zone of university faculty members in making prolific use of library resources and others such as consortia-based e-resources for effective decision making in the digital environment. The libraries of both the universities in the present ICT environment are making all out efforts to allow access the resources to the faculties but it all depend upon the skills and competencies of the faculties to access the same for education and research and this has become a practical problem to access and make use of resources.

1.10.2 Objective of the Study

The objectives of the present study are to:

1. Identify the status of e- resources and its allied equipment and infrastructure available in central library of both university
2. Identify the frequency and purpose of using e-resources by faculty members
3. Ascertain the level of skills and competency of faculty members of both the universities in accessing e-resources.
4. To identify programmes or avenues facilitated by the university to

promote ICT skills and competencies of faculty members.

5. Assess the ability of the faculty members of both the universities to critically evaluate various e-resources.
6. Identify the level of usage of different library resources to excel in teaching and research.

1.10.3 Research Methodology

Research methodology refers to the practical of the research process. It is the systematic structuring of the research on the approach used to collect, analyze, and interpret quantitative or qualitative data to answer research questions or test hypotheses.

1. **Research Sites**

   The present study is descriptive in design and qualitative in nature. The unit of the study is the individual faculty members of Mizoram University (MZU) and North-Eastern Hill University (NEHU). All faculty members of every existing academic department of both universities are taken into account.

2. **Sampling Technique**

   Stratified proportionate random sampling technique is used to select the respondents, where different academic departments of both the university remain the main strata.

3. **Sample Size**

   No standardised formula was used for the determination of sample size rather; structured questionnaire was distributed among faculty members of NEHU and MZU to cover all the academic departments of both universities. Out of the total questionnaire distributed a number of 246 were re- claimed from NEHU while a total of 160 questionnaires were re-claimed from MZU. Thus, the size of the universe for the present study (viz. faculty member of NEHU and MZU)

is 547 while the total sample size remains 406 which account to 74% of the total existing faculty strength of NEHU and MZU.

Table 1.2: Details of selection of sample

Sl. No	Name of University	No. of existing faculty member	No. of faculty member participated
1	NEHU	310	246
2	MZU	237	160
	Total	**547**	**406**

Source: Primary data

4. Data Collection

Questionnaire method is applied to solicit opinion from the faculties proportionally represented from all the disciplines of both the universities under study. Structured questionnaire duly designed for the faculty members of MZU and NEHU. Scheduled questionnaire is designed to obtain necessary data from the librarian. Secondary sources will be collected from various literatures and documents such as books, journals, thesis, etc.

1.10.4 Chapterization

The present study has 5 chapters. Chapter 1 is Introduction which contain road insight into the main context of the research, it also deals in illustrating the details of NEHU and MZU. It contains review of literature and other research methodologies implied for the current study. Chapter 2: The Concept of E-Resources: This chapter contains a comprehensive insight into the concept of e-resources. It dives deeply into its meanings, creation, types, source, structure, etc. Chapter 3: Information and Communication Technology (ICT) Skills and Competencies: This chapter illustrate the meaning of ICT and ICT Skills, it also traces the history of information technology and how is culminates to the present day. Chapter 4: Data Analysis and Interpretations: In this chapter data obtained through the questionnaire is analysed using statistical tools. Chapter 5: Findings Conclusion and Suggestion: This chapter provides details of findings extracted through analysis of the data obtained.

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2.1 Introduction:

Significant advancements in the field of digitization over the last decade have fundamentally reformed the whole global environment. These include a dramatic rise in the quantum of information exchange, knowledge sharing, fast development in the ICT industries, and widespread adoption of Internet technology. The fusion of ICT, the Internet, and the establishment of the World Wide Web led to significant modifications in the ways and means of modern man's daily life. The impact of ICT and digital technologies prompted the establishment of several innovative technologies that change the conventional lifestyle of a man into non-conventional systems. This transition to the digital era was inescapable, and organizations of all sorts must comprehend these developments in order to survive and prosper in this environment. Anna Vorobiova in her article about the changes brought about by the digital age stated:

> "The way we live, work, and play has changed dramatically over the course of the past half-century. The 9-5 economies of years past have been replaced with globally integrated 24/7 service offerings. Consumers in the digital age have access to a host of services and products that would have previously been considered available only in the realms of science fiction. This change has been a long time coming and while the industrial revolution helped start this transformation, it is only now in the information age those individuals are really able to embrace these changes. In this new digital age, access to knowledge is greatly improved. Data that was previously only accessible to scientists and government officials are now freely accessible to all. In many ways, this is a double- edged sword, as merely having access to information is not a recipe for success. It is important to understand the context of the information and data and also how it can best be used to be successful. However, the pace of

> change is only increasing. New advancements in Artificial Intelligence, Machine Learning, and the Internet of Things will only provide more information. Along with these advances, changes in networking speeds with the launch of 5G and devices capable of accessing these speeds will further propel digital age technologies forward. When trying to understand what the digital age is, it is important to realize that it is one driven by technology. These changes, when implemented within businesses to increase competitiveness, can help make businesses more efficient and profitable." (Vorobiova, 2022)

One of the most extensively affected fields by the development of digital technology is the education sector. It enables effective communication between the teacher and the learner and also helps in introducing more innovative and creative ways of teaching and learning process. Knowledge exchange has been a simple and efficient activity since digital technology and the education sector were encountered. Simple access to information sources facilitates quick content distribution, storage, and analysis from a certain angle. The primary benefit of using digital methods and procedures is the capacity to sort through massive amounts of data. The influence of digital technology on education is, however, far broader and deeper than only knowledge acquisition. It also extends to keeping a library of books and data as well as gathering the synthesized data for further analysis. Modern technology removes numerous obstacles to learning and helps both teachers and students throughout the process.

The development of an electronic format for information resources, known as "e-resource," which has various advantages over traditional knowledge resources, is one of the most significant products of the digital era as far as the education sector is concerned. Digital assets that may be accessed through electronic devices are known as "e-resources," or electronic resources. A broad

variety of items, including e-books, e-journals, research databases, digital archives, and multimedia content, may be included in its reach. As more and more individuals are using the internet for study and education, e-resources have grown in popularity. In comparison to conventional print publications, they provide a number of benefits, including rapid access, search ability, and the capacity to include multimedia information. E-resources are accessible all around the clock and absolutely capable of remote access, it enhanced the virtual accessibility of information without a physical presence in a library. E- Resources can be customized to suit each learner's needs. For instance, e-learning courses may be customized to each student's learning preferences and speed. As a result, material may be retained more effectively by pupils since they can study at a speed that is comfortable for them. E-resources have also provoked lifelong learning with rich and creative modules for enhancing skills in different areas.

2.2 Meaning of E-Resource:

An electronic resource is a knowledge resource that needs to be accessed and used through an electronic device. E-resources include both online and offline resources, such as CD-ROMs. E-resources are any products that a library makes available over a computer network. The term "electronic resources" also refers to digital data collections, full-text search engines, electronic reference books, and bibliographic databases that are available online. They both contain "born digital" content that was created exclusively online. For instance, digitized print resources, databases, and electronic journals. The libraries do not "own" the electronic resources, e-journals, or online databases the way they do the printed books.

Padval (2022) defines an e-resource as “a resource which requires computer access or any electronic product that delivers a collection of data, be it text referring to full-text bases, electronic journals, image collections, other multimedia products and numerical, graphical or time-based, as a commercially available title that has been published with an aim to being marketed. These may

be delivered on CD ROM, on tape, via internet, and so on." In view of the above definition, it can be understood that e-resources as the name suggest is based on electronic platform.

Kumari (2015) in her article defined e-resources as "those electronic information resources and services that users access electronically via a computing network from inside the library or remote to the library." This definition widens the concept of e-resources by including several computer-based services which function to provide information to its users.

According to Suresh & Ravi (2020), "An electronic resource is defined as a resource which requires computer access or any electronic product that delivers a collection of data, be it text referring to full-text bases, electronic journals, image collections, other multimedia products and numerical, graphical or time-based, as a commercially available title that has been published with an aim to being marketed." This definition has included the concept that e-resources may not necessarily be free of cost it also includes all premium or paid computer-based services and knowledge resources which is made for profit making.

Vellaichamy & Jeyshankar (2015) defined e-resources as, "Electronic resources form one of many formats that the Library collects to support its universal collections. Electronic resources include websites, online databases, e-journals, e-books, and physical carriers in all formats, whether free or fee-based, required to support research in the subject covered, and maybe audio, visual, and/or text files."

IFLA (2012) defines e-resources as, "Those materials that require computer access, whether through a personal computer, mainframe, or handheld mobile device." LIS Education Network (2014) stated that "E-resources (electronic resource) is Information (usually a file) which can be stored in the form of Electrical signal usually, but not necessarily on a computer."

2.3 Types of E-Resources:

The notion of e-resources is very extensive and ever-growing with the development in the fields of Information and Communication Technology (ICT). Types of e-resources can vary on the bases of their originality, attributes, and accessibility. However, the present study identified types of e-resources as given below:

1.3.1 Born digital e-resources:

Born digital e-resources are those e-resources that primarily came in digital format. They are created as well as managed in digital form right from the beginning. Some common types of born-digital e-resources are:

1. **Digital photograph:** With the inception of digital cameras the method of traditional photography has been substituted at large. Traditional photography using a camera and roll-film which has to undergo several treatments inside the darkroom to become an end product has been substituted by digital cameras which produce image files in electronic format at an instance, these are called digital photographs, it became digital at instant when it is captured.
2. **Digital documents:** Digital documents are those documents that are created in digital form. Formats of digital documents include docs, docx, pdf, txt, etc. Digital Documents have taken the modern academic community at large, and scholarly communication through digital documents has been extensively promoted by the advances of ICT. There have been several e-journals and e- books which have been created solely on digital forms.
3. **Harvested web content:** Harvested web content is an internet archive collected on the web domain. These archives are harvested by institutions or any other agencies based on their purpose. The data so harvested are

kept in ISO standard WARC (WebARChive) file format.

4. **Electronic Record*:*** Government records as well as corporate, institutional, and organisational archives fall under this category. The majority of the documents in this kind of collection might be in word processing formats, but they might also contain a variety of e-mails, databases, spreadsheets, presentations, and other kinds of files, some of which can only be seen with specialized software. The majority of the time, it is beneficial to remove content from exclusive formats. Instead of only conducting clean-up, archivists should be involved in establishing policies for their organizations.

2.3.2 Digitised e-resources:

Digitised e-resources are not originally created in digital format. They are those e-resources that are created traditionally and later converted into digital format. With the intervention of Personal Computers and the internet in the late 20th century, digitization became more widespread. Many diverse types of information, including text, photos, audio, and video, might be converted into digital formats. Digitization has transformed trade and communication and had a significant impact on almost every facet of contemporary life. The benefits of digitization are manifold. Digital data can be shared, retrieved, and saved easily. In the modern business environment, where information needs to be rapidly and easily accessible by staff, clients, and partners, this is extremely crucial. Digital data has the added benefit of being easier to modify than analog data. This equates to easier data analysis and decision-making for enterprises. Further, by eliminating the need for paper documents and other analog materials, digitization can help firms save money. Some common processes of digitization are:

1. **Scanning:** Scanning refers to a methodically dynamic precise and concentrated beam of light or electrons over a surface for the cause of

identical production in image file or pdf format. Scanning is done through scanners such as:

a) **Flatbed Scanners:** A flatbed scanner is a sort of scanner that's frequently used to digitize or transform tangible objects into digital format, including flat materials like images and papers. It is made up of a scanning head with a number of sensors, a glass bed or platen, and a light source that lights the paper. When using a flatbed scanner, you lay the paper down face down on the glass bed and secure it in place by closing the lid. A digital file that can be saved on a computer or other device is created as the scanner head goes across the page, collecting the image or text line by line. Flatbed scanners are frequently used for high-resolution image scanning in the publishing business as well as document scanning in offices, homes, and libraries. They come in a wide variety of ranges from basic devices appropriate for personal use to high-end scanners used in commercial settings, they come in a variety of sizes and scanning resolutions. Additionally, some flatbed scanners offer extra capabilities like automatic document feeders that let you scan numerous sheets simultaneously without manually laying each one on the glass bed.

b) **Sheet fed Scanners:** A sheet fed scanner is a type of scanner that is designed to scan individual sheets of paper as they are fed through the device. Unlike a flatbed scanner, which requires the user to manually place each page on the scanner bed, a sheet fed scanner has an automatic document feeder (ADF) that can hold multiple pages at once and feed them through the scanner one at a time. There are several sizes of sheet fed scanners, from compact and portable to huge and powerful versions. They can scan a paper on one side only (simplex scanning) or on both sides (duplex

scanning). A variety of media types, including thick cardboard, ID cards, and even three-dimensional objects, can be scanned by some sheet fed scanners.

c) **Handheld Scanner**: A handheld scanner is a portable electronic device that can scan physical documents and images and convert them to digital format. A useful tool for individuals and professionals who need to digitize documents on the go. Handheld scanners typically use contact image sensor (CIS) or CCD (charge-coupled device) technology to capture images of documents. Some models also have additional features such as Optical Character Recognition (OCR) software that can convert scanned text into editable text format. Handheld scanners come in a variety of sizes, some small enough to fit in your pocket. It is powered by a battery or a USB connection to your computer, and some models may have built-in memory to store scanned documents. Handheld scanners are useful for scanning documents such as receipts, business cards, and notes, as well as photos and artwork. It is also commonly used in industries such as healthcare and logistics to scan barcodes and other data on goods.

d) **Drum Scanner:** Drum scanner is a high end scanner used in the printing and publishing sector to create digital images with a high resolution of photographs, artwork, and other printed materials. The original piece of art or photograph is rotated on a cylinder drum as a scanning head glides across the surface and records the image line by line. Drum scanners are frequently used in applications requiring extremely high-quality images, including as fine art reproduction, high- end advertising, and scientific research. They are noted for their excellent resolution and colour accuracy.

However, drum scanners are also relatively expensive and require a high degree of skill to operate effectively, so they are typically used only by professional graphic designers, printers, and photographers who require the highest quality images.

2. **Optical Character Recognition (OCR):** OCR is a program capable of analysing and recognition of text within image file it is also used to recognized image forms. OCR programs works primarily by identifying the black and white region of the scanned document. In this process the white region are recognised as background and the black region are recognised as characters. The black region are further analysed to identify the correct identity of the characters and produced in ASCII code. Simplilearn (2023) updated that the core techniques of OCR are:
    a) Image pre-processing
    b) Artificial Intelligence character recognition
    c) Post processing

3. **Recording:** Recording refers to the process of capturing sounds or performance for reproduction or broadcasting. Recording are done using audio recorders or video cameras. There are two method of recording, they are:

    a) Optical recording: Optical recording is a technique for storing digital information by using laser technology to make minuscule pits or bumps on the surface of a disc or other storage medium. By reflecting off these lumps or pits and gauging the strength of the reflection, the laser reads the data. Due to their ability to store high-definition video and larger storage space than DVDs. Two main types of optical recording are Compact Disc (CD) and Digital Versatile Disc (DVD) however, Blu- ray Discs have grown in popularity, a dual-layer Blu-ray disc may hold up to 50GB of data.

Optical recording has been extensively used for a variety of reasons, including music, movies, data backup, and archiving.

b) **Magnetic recording:** On magnetic storage devices like hard disc drives, tape drives, and magnetic strips, digital data is stored via a technique called magnetic recording. By magnetising minuscule regions known as magnetic domains, which stand in for the binary digits (bits) of information, the data is stored on the magnetic surface of the media. Although magnetic recording has been utilised for many years in different types of storage media, new developments in the technique have allowed for higher data storage densities. Magnetic recording perpendicular to the plane (PMR), which was created in the early 2000s, is one such development. The practise of Shingled Magnetic Recording (SMR), which enhances the density of tracks on a hard drive by overlapping them like shingles on a roof, is another development in magnetic recording. Hard disc drive capacities could be considerably increased with SMR, but it also requires particular data management and may result in slower write speeds.

Generally speaking, magnetic recording is still a crucial technology for data storage, and ongoing research and development are producing new, more effective magnetic recording techniques.

4. **Sampling:** An analogue waveform's amplitude, or signal strength, is measured by sampling at regularly spaced time intervals, and the samples are then represented as numerical values for input as digital data.

2.3.3 Free e-resources:

On the bases of accessibility e-resources are divided in free and premium e- resources. Free e-resources are those which can be accessed without any

payments of any forms. Some examples of free e-resources are:

1. National Digital Library of India (NDL) https://ndl.iitkgp.ac.in/)
2. Directory of Open Access Journals (DOAJ) https://doaj.org/
3. Directory of Open Access Books https://www.doabooks.org/
4. National Programme on Technology Enhanced Learning (NPTEL) https://nptel.ac.in/
5. Shodhganga-a reservoir of Indian The https://shodhganga.inflibnet.ac.in/
6. Open Access Thesis & Dissertations https://oatd.org/
7. PubMed Central (PMC) www.ncbi.nlm.nih.gov
8. Project Gutenberg https://dev.gutenberg.org/
9. AGRIS http://agris.fao.org/agris-search/index.do

2.3.3 Premium e-resources:

Premium e-resources are accessible only through payments. Payment gateways are provided and the method of purchase may be subscription based or onetime payment purchase. Some examples of premium e-resources are:

1. E-Databases Biological Abstracts (Ovid)
2. CMIE Economic Outlook
3. CMIE States of India
4. EBSCO Library and Information Science Resource
5. IEEE/IET Electronic Library (IEL)
6. Indiastat
7. JGate Plus (JCCC)
8. Library and Information Abstracts (LISA)
9. SCOPUS
10. India Taylor and Francis
11. Web of Science
12. Emerald

13. JSTOR

14. Oxford University Press (OUP)

15. Royal Society of Chemistry Gold

16. Science Direct

17. Society for Industrial and Applied Mathematics (SIAM)

18. Springer Link

19. Taylor and Francis

20. Wiley Blackwell Publishing

2.4 Structure of E-resources

Structure of e-resource refers to the format in which it is created or available there are several formats for each of text files, images, audio files and video files. Some of the most common structure of e-resources are:

1. **Portable Document Format (PDF):** Portable Document Format (PDF) is a file format developed by Adobe Systems in the early 1990s. It was created as a way to share documents across different computer systems while preserving their formatting and layout. PDF files are widely used for storing and sharing electronic documents in a platform-independent manner. Some key features and characteristics of PDF:

    a) **Cross-platform compatibility:** PDF files can be opened and viewed on different operating systems, such as Windows, macOS, and Linux, using various PDF reading software.

    b) **Document preservation:** PDFs are designed to maintain the visual appearance and layout of documents, regardless of the software, hardware, or operating system used to view them. This makes PDFs suitable for sharing documents that should look the same to all recipients

c) **Compact file size:** PDF files can be compressed to reduce their file size without significant loss of quality. This makes them suitable for efficient storage and transmission of documents over the internet.

d) **Security features:** PDF supports various security features, such as password protection, encryption, and digital signatures. These features help protect sensitive or confidential information in the documents.

e) **Interactive elements:** PDF files can contain interactive elements like hyperlinks, bookmarks, forms, multimedia content (audio, video), and JavaScript. These features allow for enhanced user experience and interactivity within the document.

f) **Read-only format:** By default, PDFs are read-only, meaning that they cannot be easily edited or modified without specialized software. This feature helps preserve the integrity of the original document.

g) **Printing and resolution independence:** PDFs can be printed on different printers or devices while maintaining the intended layout and resolution of the document. This ensures that the document will look the same when printed on different systems.

To create and view PDF files, various software applications are available, both from Adobe (Adobe Acrobat) and other third-party developers. Additionally, many modern web browsers have built-in PDF readers, allowing users to view PDF files directly within the browser.

2. **Word document (doc. and docx.):** Word documents, commonly saved with the .doc or .docx file extension, are files created and used by Microsoft Word, a popular word processing software. Word documents are

widely used for creating, editing, and formatting textual content, making them versatile for a variety of purposes, such as writing letters, reports, essays, or even designing flyers and brochures. An overview of Word documents include:

a) **File Formats:** The .doc format was the default file format used by Microsoft Word versions prior to Word 2007. It is based on a binary file format and may not be compatible with newer versions of Word without conversion. Microsoft introduced the .docx format as the default file format. It is based on XML (Extensible Mark-up Language) and is more compact, efficient, and compatible with newer versions of Word.

b) **Text Formatting and Styling:** Word documents offer extensive features for formatting and styling text, including font selection, size adjustment, text alignment, bold, italics, underline, strikethrough, colour, highlighting, indentation, line spacing, and more. It allows you to create professional-looking documents with various formatting options.

c) **Page Layout and Design:** Word provides tools for adjusting page size, margins, orientation (portrait or landscape), headers and footers, page numbering, and other layout-related settings. Additionally, it supports features like columns, tables, images, shapes, and SmartArt for designing visually appealing documents.

d) **Collaboration and Reviewing**: Word documents facilitate collaboration among multiple users. Features like track changes, comments, and the ability to compare and merge documents allow for efficient editing, reviewing, and feedback exchange.

e) **Templates:** Word includes a range of built-in templates to help users create documents quickly. Templates offer pre-designed layouts

for various purposes, such as resumes, newsletters, brochures, and more. Custom templates can also be created and saved for future use.

f) **Compatibility:** Word documents can be opened and edited by Microsoft Word on Windows and macOS, as well as other word processing software like LibreOffice and Google Docs. However, some advanced formatting and features may not be fully compatible across different software.

g) **Export and Conversion:** Word documents can be saved in different formats, such as PDF, plain text (.txt), Rich Text Format (.rtf), and more. Conversely, other document formats can be imported into Word for editing and formatting.

Word documents provide a versatile platform for creating and editing textual content with a wide range of formatting options. They are widely used in professional, academic, and personal settings for creating various types of documents.

3. **Hypertext Mark-up Language (HTML):** Hypertext Mark-up Language (HTML) is the standard mark-up language used for creating and structuring web pages. It forms the backbone of web content and is the primary language for describing the structure and presentation of web documents. Some features and of HTML are:

   a) **Structure and Elements:** HTML uses a set of tags to define the structure and content of a web page. These tags, enclosed in angle brackets (< >), are known as HTML elements. Elements can include headings, paragraphs, images, links, lists, tables, forms, and more. Each element serves a specific purpose and contributes to the overall structure of the web page.

   b) **Hierarchical Structure:** HTML documents have a hierarchical

structure, with an opening <html> tag at the beginning and a closing

</html> tag at the end. The main content of the page is placed within the

<body> tags, while the <head> section contains meta-information about the document, such as the title, character encoding, CSS stylesheets, and JavaScript code.

c) **Tags and Attributes:** HTML elements are defined by tags, and they can also include attributes that provide additional information about the elements. Attributes are specified within the opening tag and can modify the behavior or appearance of the element. For example, the <a> element for links can have attributes like href (the URL of the link) and target (specifying how the link should open, such as in a new window or tab).

d) **Text and Multimedia Content:** HTML allows you to add and format text content using elements like headings (<h1> to <h6>), paragraphs (<p>), emphasis (and), line breaks (<br>), and more. It also supports the inclusion of multimedia content, such as images (<img>), audio (<audio>), and video (<video>), using appropriate tags.

e) **Links and Navigation:** HTML provides the <a> (anchor) element for creating hyperlinks. Links can be used to navigate within the same document, link to external web pages, or link to specific parts of a web page. HTML also offers structural elements like <nav>, <ul>, and <li> for creating navigation menus and lists.

f) **Forms and User Input:** HTML includes form elements (<form>, <input>, <select>, <textarea>, etc.) that enable users to input data

and submit it to a server. Forms are essential for interactive web pages, such as login forms, contact forms, surveys, and more.

g) **Styling and Layout:** HTML focuses on structure and content, while Cascading Style Sheets (CSS) is used for styling and presentation. CSS allows you to control the visual appearance of HTML elements, including colours, fonts, margins, padding, layout, and more. CSS can be linked to HTML documents using the <link> element or defined inline within the HTML using the style attribute.

HTML is a fundamental language for web development and is supported by all web browsers. It provides a standardized way to create and structure web content, making it accessible, searchable, and easily interpretable by both humans and machines.

4. **Microsoft Excel Spreadsheet (xls. and xlsx.):** Microsoft Excel is a powerful spreadsheet program developed by Microsoft. It is part of the Microsoft Office suite and provides a wide range of features and functionality for creating, organizing, analyzing, and presenting data in a tabular format. Functions of excel sheet are:

   a) **Grid Structure:** Excel organizes data into a grid of cells, with columns labeled alphabetically (A, B, C, etc.) and rows numbered (1, 2, 3, etc.). The intersection of a column and a row creates a cell, which is the basic unit for storing data.

   b) **Data Entry and Formatting:** Excel allows users to enter and manipulate data in individual cells. You can enter text, numbers, dates, formulas, and functions into cells. Excel provides various formatting options, such as font styles, cell borders, background colors, number formats, and alignment settings, to enhance the visual appearance of the data.

c) **Formulas and Functions:** Excel includes a vast library of built-in formulas and functions to perform calculations and automate tasks. Formulas can be created using mathematical operators and cell references. Functions, such as SUM, AVERAGE, MAX, MIN, IF, VLOOKUP, allow for advanced data analysis.

d) **Data Analysis and Visualization:** Excel provides powerful tools for analyzing and summarizing data. Features like sorting, filtering, and data validation help in organizing and cleaning data. Excel also offers advanced data analysis tools, including pivot tables, charts, and conditional formatting, to visualize and interpret data trends, patterns, and relationships.

e) **Data Manipulation and Manipulation:** Excel supports various operations to manipulate and transform data. You can perform tasks like sorting data, filtering rows based on specific criteria, merging cells, splitting data into multiple columns, and converting data between different formats.

f) **Data Collaboration and Sharing:** Excel spreadsheets can be shared and collaborated on with others. Multiple users can work on the same spreadsheet simultaneously, and changes are synchronized in real-time. Excel provides options to protect and restrict access to sensitive data through password protection and user permissions.

g) **Integration with Other Applications:** Excel seamlessly integrates with other Microsoft Office applications and external data sources. It allows you to import and export data from and to various formats like CSV, text files, databases, and web services. Excel also supports linking and embedding data from other Excel workbooks, Word documents, PowerPoint presentations, and more. Excel is widely used in various industries and professions, including finance,

accounting, project management, data analysis, research, and many others. It provides a versatile platform for organizing, analyzing, and presenting data in a structured and visually appealing manner.

5. **Text file (txt.):** A text file is a simple and commonly used file format that stores plain text data without any formatting or special characters. It is a type of computer file that contains textual information in a basic, human-readable form. Text files typically use the .txt file extension, which indicates that the file contains plain text. They do not include any special formatting or embedded objects like images or graphs. It consist of sequences of characters encoded using a character encoding standard, such as ASCII (American Standard Code for Information Interchange) or Unicode. They can include letters, numbers, punctuation marks, and other standard characters, but they do not support rich formatting or advanced text features. Text files can be easily created and edited using various text editors, including built-in editors like Notepad on Windows or TextEdit on macOS. It is highly portable and can be opened and read on different operating systems, including Windows, macOS, Linux, and Unix. They are considered a universal format for sharing plain text data across different platforms. Text files are typically small in size because they do not contain any complex formatting or multimedia elements. They are efficient for storing and transferring text-based information. They can be used in various scenarios and by different applications. They are commonly used for storing configuration files, program source code, log files, data exports, and other types of plain text information. Since text files lack formatting options, they do not support features like bold, italics, font styles, tables, or embedded images. Additionally, they do not support complex data structures or hierarchical organization. It also provide a simple and flexible format for storing and exchanging plain text information. They are widely used for various purposes, such as storing

code snippets, writing documentation, recording notes, creating data files, and more. Due to their simplicity and portability, text files are highly compatible and can be easily processed by different software applications and programming languages.

6. **Rich Text Format (rtf.):** Rich Text Format (RTF) is a file format that allows for more advanced formatting options than plain text files while still remaining compatible across different platforms and applications. RTF files can store text-based documents with formatting attributes, such as font styles, colours, sizes, alignment, and more.

   RTF files are encoded in ASCII or Unicode and can be opened and edited by various word processing software, including Microsoft Word, LibreOffice Writer, and Google Docs. RTF supports a wide range of formatting options, including font styles (bold, italic, underline), font colors, font sizes, paragraph alignment (left, right, center, justified), indents, bullet points, numbered lists, tables, hyperlinks, and more. These formatting attributes can be applied to different sections of the document or specific text portions. Compatibility: RTF files are designed to be platform-independent, allowing them to be opened and viewed on different operating systems and word processing software that support the RTF format. This ensures consistent formatting across various platforms. Images and Objects: RTF files can include images, drawings, and other objects. Images can be inserted within the document and positioned along with the text. Additionally, RTF supports the embedding or linking of external objects, such as spreadsheets, charts, and multimedia files. Due to the inclusion of formatting information, RTF files are generally larger in size compared to plain text files. However, they are still considerably smaller than binary formats like DOC or DOCX, which contain additional metadata and complex formatting. RTF files can be created and edited using

word processing software that supports RTF format. Users can apply formatting styles, modify text, insert images and objects, and perform various editing operations. The files can be saved and reopened for further editing without losing formatting details.

While RTF offers more advanced formatting options than plain text files, it does not support the full range of features found in proprietary document formats like DOCX. Some complex formatting or advanced features in specific word processors may not be fully supported or compatible across different software. RTF provides a balance between plain text and more complex document formats. It allows for basic formatting options to enhance the appearance of the text without requiring proprietary software. RTF is commonly used for exchanging formatted documents, sharing content across different platforms, and preserving the overall layout and styling of the document.

7. **Adobe Illustrator file (ai.):** An Adobe Illustrator file is a proprietary file format created by Adobe Systems and used by their vector graphics editing software, Adobe Illustrator. Illustrator files are typically saved with the .ai file extension. Adobe Illustrator is primarily used for creating and editing vector graphics, which are composed of mathematical equations and scalable shapes. Unlike raster images (such as JPEG or PNG), vector graphics can be scaled up or down without losing quality. Illustrator files (.ai) are the native file format for Adobe Illustrator. They contain information about the artwork, including vector shapes, paths, text, colours, layers, and other design elements.

   Illustrator files can be edited and modified using Adobe Illustrator or other software that supports the .ai format. Users can manipulate and adjust individual vector objects, change colors, apply effects, create text, and work with layers to organize and manage different elements of the

artwork. Illustrator files are resolution-independent, meaning that the artwork can be resized or output at any resolution without loss of quality. This makes them suitable for various purposes, including print, web, and multimedia projects.

Adobe Illustrator files can be opened and edited in Adobe Illustrator on both Windows and macOS platforms. However, opening .ai files in other software may require conversion or exporting to a different file format, such as SVG (Scalable Vector Graphics) or PDF (Portable Document Format). Illustrator files can be relatively large, especially if they contain complex artwork with multiple layers, effects, and high-resolution images. The file size may vary depending on the complexity and number of elements in the design. Adobe Illustrator provides various export options to save artwork in different file formats, such as EPS (Encapsulated PostScript), PDF, SVG, PNG, and more. Exporting allows the artwork to be used in other software, shared with clients or collaborators, or published on the web.

Adobe Illustrator is widely used by graphic designers, illustrators, and other creative professionals for creating logos, icons, illustrations, typography, and other types of vector-based artwork. Illustrator files provide a flexible and editable format for storing and working with vector graphics, allowing for precise control over design elements and scalability.

8. **Bitmap image (bmp.):** A Bitmap Image, commonly referred to as a BMP file, is a standard raster graphics file format used to store digital images. Bitmap images are composed of a grid of pixels, where each pixel represents a single point of color information. BMP files have the .bmp file extension and are commonly associated with Windows-based systems. They are typically uncompressed and store raw pixel data without any loss compression, resulting in large file sizes compared to compressed image

formats. Bitmap images are made up of a rectangular grid of pixels, with each pixel representing a specific colour or shade. The resolution of a BMP image is determined by the number of pixels horizontally and vertically, often measured in pixels per inch (PPI) or dots per inch (DPI).

BMP supports various colour depths, ranging from 1-bit (black and white) to 24-bit (true colour), and even higher depths for specific variants of the format. The colour depth determines the number of unique colours that can be represented in the image. BMP files typically use a lossless compression method, which means that the image data is stored without any loss of quality. This results in larger file sizes compared to compressed formats like JPEG or PNG. BMP is a widely supported format and can be opened and edited by most mage viewing and editing software. It is compatible with both Windows and macOS systems, as well as other operating systems and image editing tools. BMP files have limited support for metadata, such as image resolution and colour profile information. However, they do not support advanced metadata like EXIF data commonly found in formats such as JPEG.

BMP files are suitable for specific use cases, such as certain printing or editing requirements that may require an uncompressed and lossless format. However, due to their larger file sizes, they are less commonly used for general web publishing or sharing images online. While BMP files offer high-quality and uncompressed representation of images, their large file sizes and limited compression make them less suitable for web or file-sharing purposes. Other formats, such as JPEG, PNG, or GIF, are generally preferred for such use cases due to their smaller file sizes and broader compatibility.

9. **GIF image (gif.):** A GIF (Graphics Interchange Format) image is a file format that supports both static and animated images. It is a popular format

for sharing simple animations, short video clips, and graphics on the web. GIF files have the .gif file extension. They use a lossless compression algorithm, which means that the image quality is preserved without any loss of detail. This compression technique allows for relatively small file sizes compared to other animation formats. GIF images use a limited color palette of up to 256 colors. This limitation makes GIF less suitable for displaying high-quality, complex images with a wide range of colors, but it works well for simple graphics, icons, and animations.

One of the notable features of GIF is its ability to support animations. A GIF animation is created by combining multiple frames into a single file, and each frame can have its own timing and duration. When displayed, the frames are played sequentially, creating the illusion of movement. GIF supports transparency, which means that a specific color in the image can be designated as transparent. This allows the GIF image to blend seamlessly with the background on a web page, making it suitable for creating images with irregular shapes or for overlaying on top of other content. GIF animations can be set to loop continuously or play a specified number of times. Looping is commonly used to create repetitive or looping animations, such as loading icons or small animations for website elements.

GIF is widely supported by web browsers and can be displayed on most web pages without the need for plugins or additional software. It has been a popular format for sharing animations and graphics on the web for many years. The file size of a GIF image depends on factors such as image dimensions, color complexity, and the number of frames in an animation. While GIF files are generally smaller compared to video formats, larger or longer animations can result in larger file sizes.

GIF images are commonly used for creating simple animations,

displaying icons, logos, and short video clips, and sharing them on the web. They provide a lightweight and widely supported format for conveying motion and graphics, particularly in situations where other video formats may not be necessary or practical.

10. **Icon file (ico.):** An ICO (Icon) file is a file format used to store and display icons on various computer systems and applications. ICO files contain small- sized images or graphics that represent an application, file, folder, or other elements within a graphical user interface. ICO files play a vital role in visual representation within graphical user interfaces, helping users identify and locate applications, files, and folders. They provide a standardized format for storing and displaying icons, ensuring consistent visual presentation across different parts of the operating system or software applications.

    ICO files have the .ico file extension and are commonly associated with Windows-based systems. They are essentially container files that can store multiple sizes and color depths of the same icon. ICO files can contain multiple sizes of an icon image, typically ranging from 16x16 pixels up to 256x256 pixels or larger. Each size may have different color depths, including 1-bit monochrome, 4-bit grayscale, 8-bit indexed color, or 32-bit with an alpha channel for transparency. ICO files support transparency, allowing icons to have transparent areas that blend seamlessly with the background or underlying interface elements.Specialized software or icon editing tools are used to create and edit ICO files. These tools enable designers to create pixel-perfect icon designs, assign appropriate sizes and color depths, and optimize the icon for different display environments.

    ICO files are commonly used to represent applications or programs on the desktop, in file explorers, or within taskbars and menus. Each

application may have its own associated ICO file that contains the icon representation. ICO files are also used for system icons, such as the Recycle Bin, folder icons, drive icons, or file type icons. These system icons provide visual cues and help users identify different elements within the operating system. ICO files can be converted to other image formats, such as PNG or JPEG, for use in web pages, multimedia projects, or non-Windows platforms. Conversion tools or graphic editing software can be used to perform this conversion.

ICO files are primarily associated with Windows-based systems and are widely supported by Windows operating systems and applications. However, many other operating systems, such as macOS and Linux, can also display ICO files or convert them to their respective native icon formats.

11. JPEG image (jpeg. or jpg.): JPEG (Joint Photographic Experts Group) is a widely used file format for storing and sharing digital images. JPEG images are highly compressed to reduce file size while maintaining acceptable image quality. JPEG files typically have the .jpg or .jpeg file extension. They are supported by a wide range of devices, software applications, and web browsers. JPEG uses high compression, which means that during the compression process, some image data is discarded to reduce file size. The level of compression can be adjusted, with higher compression resulting in smaller file sizes but also lower image quality. JPEG compression selectively discards less noticeable image details, such as high-frequency components and color information that may be less perceptible to the human eye. This compression method allows for significant file size reduction while maintaining reasonable image quality, especially when using lower compression settings.

JPEG supports the RGB color space, which is commonly used for

digital images. It can display millions of colors, making it suitable for photographs, graphics, and natural scenes. Due to the lossy compression, JPEG images may exhibit compression artifacts, which can manifest as blocky areas, blurring, or color distortions. These artifacts become more noticeable with higher levels of compression. Progressive JPEG is a variant of the JPEG format that allows for gradual loading of images. Instead of waiting for the entire image to load, progressive JPEGs initially display a low-resolution version, which gradually improves in quality as more data is loaded.

JPEG files can store metadata, also known as EXIF (Exchangeable Image File) data. This metadata includes information such as camera settings, date and time of capture, GPS coordinates, and other details about the image. This information can be viewed and edited using various software applications. JPEG is compatible with numerous devices, operating systems, and software applications. It is widely supported by web browsers, making it a popular format for sharing images online and displaying visuals on websites.

JPEG images are commonly used for a wide range of applications, including digital photography, web graphics, social media, and digital publishing. They strike a balance between file size and image quality, making them suitable for efficient storage and quick transmission of visual content. However, it's important to consider the appropriate compression level to balance file size and image fidelity for specific use cases.

12. **PNG image (png.):** PNG (Portable Network Graphics) image is a widely used file format for storing and displaying digital images. PNG is a raster graphics format that supports lossless compression, transparency, and a wide range of color depths. PNG uses lossless compression, meaning that it retains all the original image data during the compression process. This

ensures that there is no loss of quality when saving or sharing PNG images. PNG files typically have the .png file extension. They are supported by most operating systems, web browsers, and image editing software. PNG images maintain high image quality by preserving all the original details, colors, and gradients. This makes PNG suitable for graphics, logos, and images with sharp edges or text, where preserving fine details is important. PNG supports alpha channel transparency, which allows for partial or full transparency within an image. This makes PNG ideal for creating graphics with non-rectangular or irregular shapes that can blend seamlessly with different backgrounds. PNG supports various color depths, including 8-bit (256 colors), 24-bit (true color), and 32-bit (true color with alpha channel). This flexibility allows for accurate color representation and smooth transitions between shades.

PNG compression works efficiently for images with large areas of solid colors, sharp edges, or text. However, for complex photographic images with extensive color variations, PNG files may have larger file sizes compared to lossy formats like JPEG. PNG is widely supported by web browsers, making it a popular format for web graphics, icons, and logos. Its support for lossless compression and transparency makes it suitable for delivering high-quality images on websites. PNG files can store metadata, such as information about the image's creation date, author, copyright, and software used. This metadata can be accessed and modified using various software applications. PNG images are commonly used in various industries, including web design, graphic design, digital art, and image editing. They offer lossless compression, transparency support, and high-quality visuals, making them a versatile choice for a wide range of image-related applications.

13. **PostScript file (ps.):** A PostScript (PS) file is a type of computer file that

contains instructions and commands written in the PostScript language. The term "postscript" is derived from its original use, which was to add additional content or comments to a document after the main body of the text had been written. However, in the context of computer files, a PostScript file refers to a file that contains instructions for printing or rendering a document. PostScript files are primarily used in the printing industry and are designed to describe the layout, text, graphics, and other elements of a document in a device- independent manner.

PostScript is a programming language developed by Adobe Systems that describes the appearance and layout of a printed page. It uses a series of commands and operators to define text, fonts, images, colors, and other graphical elements. PostScript files are commonly used as a printer language. They are interpreted by printers or print servers that have built-in PostScript interpreters, which convert the instructions in the file into printable output. PostScript supports vector graphics, which means that the graphics described in the file are represented as mathematical equations rather than fixed pixels. This allows for scalable and high-quality output regardless of the printing resolution. PostScript files are designed to be device-independent, meaning they can be used on different printers or output devices without requiring modifications. This allows for consistent print output across various devices. PostScript files are generated by software applications and are typically used in the print industry for generating high-quality print output. Printers with built-in PostScript interpreters can directly process PostScript files and accurately reproduce the intended layout and graphics. PostScript files can be converted to other formats, such as PDF (Portable Document Format), which retains the layout and graphics of the original file while providing additional features like interactivity and security. PostScript files can be viewed, printed, or converted using software applications that support PostScript. Adobe Acrobat and other PDF tools

often include support for PostScript files.

PostScript files are less commonly encountered in everyday computer usage compared to formats like PDF or JPEG. They are primarily used in professional printing environments and for specialized applications that require precise control over the printing process.

14. **TIFF image (tif. or tiff.):** TIFF (Tagged Image File Format) is a widely used file format for storing and exchanging raster graphics images. TIFF files are known for their flexibility, support for high-quality images, and ability to store various types of image data. Here are some key features and characteristics of TIFF images: TIFF supports both lossless and lossy compression methods. Lossless compression allows for the preservation of image quality without any data loss, while lossy compression reduces file size by sacrificing some image details. The compression method used in a TIFF file can be selected based on the specific needs of the image. It typically have the .tif or .tiff file extension. They are supported by a wide range of devices, operating systems, and image editing software.

TIFF files are capable of storing high-quality images with various color depths, including grayscale, indexed color, RGB, and CMYK. This makes TIFF suitable for professional applications that require accurate color representation, such as photography, graphic design, and printing. TIFF supports different bit depths, ranging from 1-bit (black and white) to 16-bit (per color channel) or higher. This allows for the storage of images with high color depth and dynamic range, making TIFF a preferred format for archiving and preserving detailed visual data. TIFF supports layers, similar to those found in image editing software. Layers allow for the organization and editing of different elements within an image. Additionally, TIFF can also store transparency information, making it suitable for images with transparent or semi-transparent regions.

TIFF files can store metadata, which includes information about the image, such as resolution, color space, author, date, and copyright. This metadata can be accessed and modified using various software applications. TIFF is widely supported by image editing software, making it a versatile format for professional use. It allows for lossless editing and manipulation without degrading image quality. Due to its flexibility and support for high-quality images, TIFF files can have larger file sizes compared to other image formats like JPEG. This can make them less suitable for web or online use where smaller file sizes are preferred for faster loading times.

TIFF images are commonly used in professional workflows, such as photography, printing, and archiving, where maintaining image quality and preserving detailed visual data are essential. They provide a flexible and versatile format for storing and exchanging high-quality images across different platforms and software applications.

15. **WebP image (webp.):** WebP is a modern image file format developed by Google that provides efficient compression and high-quality visuals. It is specifically designed for web use, aiming to deliver smaller file sizes without significant loss of image quality. The original image is converted to the WebP format using an image processing software or a specialized converter.

    WebP utilizes advanced compression techniques, including lossy and lossless compression, to reduce the file size while maintaining reasonable image quality. The specific compression method can be selected based on the desired trade-off between file size and image fidelity. When compressing a WebP image, you can adjust the quality settings to find the optimal balance between file size and visual quality. Higher quality settings result in larger file sizes but preserve more details and colors, while lower quality settings reduce file size but may introduce some artifacts or

loss of fine details.

WebP supports both opaque and transparent images. For images that require transparency, an alpha channel can be included in the WebP file to define areas of partial or complete transparency. WebP also supports animated images through the WebP Animation format (WebP-Anim). Multiple frames can be combined within a single file to create simple animations or dynamic visuals. Once the WebP image is created, it can be easily displayed on websites, as most modern web browsers and platforms support the WebP format. The reduced file size of WebP images helps in improving website loading times and reducing bandwidth usage.

16. **AIF audio file (aif.):** AIF (Audio Interchange File Format), also known as AIFF (Audio Interchange File Format), is a popular audio file format developed by Apple Inc. It is commonly used for storing high-quality uncompressed or losslessly compressed audio data.

AIF files can store audio data in several encoding formats, including uncompressed PCM (Pulse Code Modulation) and losslessly compressed formats like Apple Lossless (ALAC) or FLAC (Free Lossless Audio Codec). PCM is the most common encoding format in AIF files, offering high-quality audio without any loss of data. AIF supports a wide range of sample rates and bit depths to accommodate different audio requirements. Sample rate refers to the number of audio samples captured per second (e.g., 44.1 kHz or 48 kHz), while bit depth determines the precision of each audio sample (e.g., 16-bit or 24- bit). Higher sample rates and bit depths contribute to better audio quality and more accurate reproduction of the original sound. AIF files can store mono (single-channel) or stereo (dual-channel) audio, as well as multi-channel audio for surround sound or immersive audio formats. The number of channels in an AIF file depends on the original audio recording or mix.

AIF files can contain metadata, such as track information, artist name, album details, and other descriptive tags. This metadata helps in organizing and categorizing audio files, making it easier to search and identify specific tracks. AIF files are widely supported by Apple's ecosystem, including macOS and iOS platforms. Many media players and digital audio workstations (DAWs) also support the AIF format. However, compared to more widely supported formats like WAV or MP3, AIF files may have limited compatibility with certain devices or applications. Uncompressed AIF files tend to be larger in size compared to compressed audio formats like MP3 or AAC. Losslessly compressed AIF formats like Apple Lossless or FLAC offer smaller file sizes while retaining audio quality, making them suitable for archiving or distribution.

AIF audio files are commonly used in professional audio production, music recording, and sound design. They provide a high-quality, lossless or near- lossless representation of audio, ensuring accurate reproduction of the original sound.

17. MP3 audio file (mp3.): MP3 (MPEG-1 Audio Layer 3) is a widely used audio file format that employs lossy compression to reduce file size while maintaining acceptable audio quality. It evolutionized the music industry by allowing for efficient storage and transmission of digital audio. MP3 uses lossy compression algorithms that remove certain audio data that is deemed less perceptible to the human ear. This selective removal of data reduces the file size significantly compared to uncompressed audio formats like WAV or AIFF. MP3 files are characterized by their bit rate, which represents the amount of data encoded per second. Higher bit rates result in better audio quality but also larger file sizes. Common bit rates for MP3 files range from 128 kbps (kilobits per second) to 320 kbps or higher, with higher bit rates generally delivering better audio

fidelity.

MP3 files have a specified sampling frequency, which determines the number of audio samples captured per second. Common sampling frequencies for MP3 include 44.1 kHz (the same as audio CDs) and 48 kHz. Lower sampling frequencies can result in reduced audio quality and potentially noticeable artefacts.

MP3 supports stereo encoding, allowing for the storage of audio content in two channels (left and right). This enables the perception of a wider soundstage and separation of instruments or audio elements. MP3 is a widely supported audio format and can be played by most media players, portable devices, and operating systems. It has become the de facto standard for digital audio and is compatible with a wide range of devices and software applications. MP3 files can contain metadata tags that store information about the audio track, such as title, artist, album, and genre. This metadata helps in organizing and managing music libraries, providing additional information about the audio content.

MP3 files are commonly used for music distribution, online streaming, and personal audio playback. Their efficient compression allows for the storage of large music collections and facilitates easy sharing and streaming over the internet. While MP3 is a lossy format, it strikes a balance between file size and audio quality, making it a popular choice for everyday audio consumption.

18. WAV file (wav.): The WAV (Waveform Audio File Format) is a widely used audio file format that stores audio data in a raw and uncompressed format. It is known for its high-quality audio reproduction and wide compatibility across different platforms and software applications. WAV files store audio data in an uncompressed format, meaning that they retain the original audio quality without any loss of data. This makes WAV

an ideal format for professionals who require pristine audio fidelity. WAV uses PCM (Pulse Code Modulation) encoding, which represents the audio waveform as a series of numerical samples. PCM preserves the amplitude and frequency of the audio signal, resulting in a faithful reproduction of the original sound. WAV files support various sampling rates (e.g., 44.1 kHz, 48 kHz, 96 kHz) and bit depths (e.g., 16-bit, 24-bit, 32-bit). The sampling rate determines the number of audio samples captured per second, while the bit depth determines the precision of each audio sample. Higher sampling rates and bit depths result in higher-quality audio but also larger file sizes. WAV files can store audio in mono (single-channel) or stereo (dual-channel) formats. Stereo allows for a more immersive audio experience by providing separate channels for the left and right speakers. WAV files can include metadata tags to store information about the audio track, such as title, artist, album, and genre. This metadata helps in organizing and managing audio files. WAV is a widely supported audio format and can be played by most media players, audio editing software, and operating systems. It is a standard format for audio recording, mixing, and mastering in professional audio production. Due to its uncompressed nature, WAV files tend to have larger file sizes compared to compressed audio formats like MP3 or AAC. This can be a consideration when it comes to storage and bandwidth usage. WAV files are commonly used in professional audio production, music recording, and broadcasting. They provide the highest quality audio reproduction with no loss of data, making them suitable for critical listening, mastering, and archival purposes.

19. **WMA audio file (wma.):** WMA (Windows Media Audio) is an audio file format developed by Microsoft, not specifically for video. WMA files primarily contain audio data and are commonly used for music playback and audio streaming. However, Microsoft also developed a video file

format called WMV (Windows Media Video) that is designed specifically for video content. WMV files, like WMA, were developed to be compatible with the Windows Media Player and the Windows operating system. They utilize advanced compression techniques to reduce file size while maintaining relatively good video quality. WMV files are often used for streaming video over the internet, as well as for storing video content on Windows-based devices.

20. **AVI file (avi.):** AVI is a multimedia container format developed by Microsoft for storing audio and video data in a single file. It is primarily used for video playback and is compatible with various media players and operating systems. AVI files typically contain both audio and video streams that are encoded using different codecs. The audio and video streams are combined within the AVI container, allowing them to be synchronized during playback. AVI files can support different video codecs, such as DivX, Xvid, or MPEG-4, and different audio codecs, such as MP3 or PCM.

21. **Matroska Video (.mkv):** MKV (Matroska Video) is a multimedia container format that can hold multiple audio, video, and subtitle streams in a single file. It is an open standard format and is widely used for storing high-definition video content. MKV is a container format, meaning it can contain various types of media data, including video, audio, and subtitles. It is similar to other container formats like AVI or MP4. MKV allows for the inclusion of multiple audio, video, and subtitle streams within a single file. This flexibility enables users to have different language options, alternate audio tracks, or various subtitle choices associated with a video. MKV supports the storage of high- quality video content, including high-definition (HD) and even ultra-high- definition (UHD) formats. It can handle various video codecs such as H.264, H.265, VP9, and more. MKV supports various audio formats, including popular ones like AAC, MP3,

FLAC, and DTS. This allows for the inclusion of different audio tracks or multiple audio channels within an MKV file. It also supports subtitle streams in different formats, such as SubRip (SRT), SubStation Alpha (SSA), or Advanced SubStation Alpha (ASS). This makes it possible to include subtitles for various languages or captions for accessibility. This video file type can contain metadata information, such as title, artist, and genre, providing additional details about the content. It also supports chapter markers for easy navigation within longer videos or films.

They are compatible with many media players, including popular ones like VLC, MPC-HC, and PotPlayer. Additionally, MKV is supported on various operating systems, including Windows, macOS, and Linux. MKV is favored by many due to its versatility, allowing for the storage and playback of high-quality video content along with multiple audio and subtitle options within a single file. It provides a convenient way to organize and distribute multimedia content while maintaining flexibility and compatibility across different devices and platforms.

22. **MPEG4 video file (.mp4):** MP4 (MPEG-4 Part 14) is a popular multimedia container format used for storing video, audio, and other media data. It is widely supported and compatible with various devices, media players, and operating systems.

MP4 is a container format that can hold different types of media streams, including video, audio, subtitles, and metadata. It is similar to other container formats like MKV or AVI. MP4 supports various video codecs (compression algorithms), such as H.264, H.265 (HEVC), VP9, and MPEG-4 Part 2. These codecs compress the video data to reduce file size while maintaining good video quality. H.264 is particularly popular and widely supported. MP4 can contain audio streams compressed using codecs like AAC, MP3, or AC3. These codecs reduce the file size while preserving

audio quality, allowing for high-quality audio playback in MP4 files. MP4 is highly compatible and can be played on a wide range of devices, including computers, smartphones, tablets, smart TVs, and media players. Many popular media players and video editing software support MP4, making it a widely used format for video distribution and sharing. This video file can contain metadata tags that provide information about the video content, such as title, artist, album, and genre. This metadata helps in organizing and managing video files and can be displayed by media players or video editing software.

MP4 is commonly used for streaming video over the internet. Its efficient compression and compatibility make it ideal for delivering video content over various platforms, including video streaming websites and social media platforms. It supports high-definition (HD) and even ultra-high-definition (UHD) video resolutions. It can store videos with different frame rates, aspect ratios, and color spaces, allowing for a wide range of video formats and qualities.

MP4 has become the standard format for video playback and distribution due to its versatility, compatibility, and support for high-quality video and audio. It is widely used for sharing videos online, storing personal video collections, and delivering video content across different devices and platforms.

23. **WebM video file (.webm):** WebM is an open and royalty-free multimedia container format designed for efficient delivery of video, audio, and other media content on the web. It was developed by the WebM Project, which is backed by Google. WebM utilizes the VP8 or VP9 video codecs for compression. These codecs offer efficient video compression while maintaining good video quality. VP9, in particular, provides higher compression efficiency compared to VP8, resulting in smaller file sizes.

WebM supports various audio codecs, including Opus and Vorbis. Opus is a highly efficient audio codec that delivers excellent audio quality even at low bitrates, while Vorbis offers a balance between audio quality and file size. It uses the Matroska (MKV) container format to hold the VP8/VP9 video streams, Opus/Vorbis audio streams, and any accompanying subtitles or metadata. The Matroska container provides flexibility and extensibility for including different types of media streams within a single file.

WebM is widely supported by modern web browsers, including Chrome, Firefox, and Opera. It is the recommended video format for HTML5 video playback, making it an ideal choice for web-based video content. WebM is suitable for streaming video over the internet, thanks to its efficient compression and broad browser support. It is commonly used for web-based video platforms, video conferencing, and other online video applications.

One of the key advantages of WebM is that it is an open and royalty-free format. This means that anyone can use the format without needing to pay licensing fees, promoting widespread adoption and compatibility. WebM has gained popularity as a format for delivering high-quality video content on the web. Its open nature, efficient compression, and compatibility with HTML5 make it an attractive choice for web developers, content creators, and streaming platforms seeking a free and accessible video format.

24. **Windows Media Video file (.wmv):** Windows Media Video (WMV) is a video file format developed by Microsoft. It is designed specifically for Windows platforms and is widely used for video playback and streaming. WMV files utilize video codecs developed by Microsoft, such as Windows Media Video 7, 8, 9, and more recently, VC-1. These codecs employ advanced compression algorithms to reduce file size while maintaining relatively good video quality.

WMV files can contain audio streams that are compressed using codecs like Windows Media Audio (WMA). This allows for synchronized playback of video and audio within the WMV file. WMV is a proprietary video format primarily designed for Windows platforms, including Windows Media Player and Windows operating systems. WMV files are compatible with Windows- based devices and can be easily played back using the built-in Windows Media Player or other media players that support WMV. WMV files are commonly used for streaming video over the internet. They support various streaming protocols and enable efficient video delivery over networks, making them suitable for online video platforms and video-on-demand services. Different versions of the WMV format offer varying levels of compression efficiency and video quality. For example, WMV 9 introduced significant improvements in compression and quality over earlier versions. WMV files support Digital Rights Management (DRM) technology, allowing content creators to protect their video content from unauthorized copying or distribution. DRM-enabled WMV files can enforce access control and content usage policies. While WMV is primarily associated with Windows platforms, there are media players and video editing software available for other operating systems that can play or convert WMV files. However, compatibility on non-Windows platforms may vary. WMV is a popular video format for Windows users due to its compatibility with Windows-based devices and support for efficient video compression. It has been widely used for a range of applications, including video streaming, video conferencing, and storing video content on Windows-based systems.

2.5 Advantages of E-Resources:

In the current digital era, e-resources are growing in popularity since they provide consumers several benefits over conventional paper-based resources. In this essay, the benefits that e-resources offer to users, institutions, and society at

large will be outlined.

1. **Round the clock accessibility:** One of the most important benefits of e-resources is its round the clock accessibility. Accessibility of e-resource is not bound by the strict timings of any library, unlike the tangible knowledge resources like books and periodicals, etc. they can be accessed any time of day and night. Users who might need to access material at odd hours to particularly benefit from this.

2. **Rich information:** One of the biggest benefits of using electronic resources is having access to enormous amounts of information. Govt. of India as well as agencies around the globe have initiated serious attempt to create more digital learning content and making it accessible to its citizens. Number of books, articles, and other pieces of information with high scholarly value have been digitised and made available online via electronic databases, online libraries, and digital archives. Because of this, people may now access a wealth of data that was previously only available in physical form from any location in the world. In addition there has been serious campaign as well as initiatives for open access which leads to hovering more scholastic information within the grasp of any users.

3. **Cost-effectiveness:** E-resources are also inexpensive for both institutions and users. Multiple use facility of e-resource has contributed to the cost-effectiveness of e-resources. Unlike the traditional one copy of document for one user a single copy of e-resource can be shared by infinite number of users. Users can benefit from the lower maintenance costs of electronic databases and online libraries, which are typically less expensive to operate than physical libraries. A larger spectrum of consumers can use e-resources because many of them are also available for free or at a lower cost than their physical counterparts.

4. **Easy Search Facilities:** The capability of the internet to harvest metadata

has made e-resources are highly searchable which makes it simple for users to locate the information they require. Users need not go through long stack of books in order to locate their desired information, rather they can locate their desired documents by simply by using search values such as Title, Author, Publisher or Keywords. Harvested metadata also provide search facilities within the database. Users of electronic databases and online libraries can efficiently and quickly conduct searches for sort of information using different search techniques as well. For users who have a pressing need to locate specific information rapidly, this function is especially useful.

5. **Flexibility:** E-resources are highly flexible. They can be edited and converted with the help of application software which enable the users to customise their search results to meet their unique needs. It is simpler to find the information you need while using electronic databases and online libraries since users may narrow their searches by date, subject, language, and other factors.

6. **Varied Information:** E-resources frequently feature a wide range of disciplines and topics. This makes it simpler to conduct interdisciplinary research and find fresh links between various fields of study because users can access information from a range of fields and disciplines.

7. **Creative:** E-resources are interactive as well, giving users a more dynamic and engaging learning experience. A lot of online resources have multimedia content, such pictures, videos, and audio files, which can improve learning and make it more fascinating and engaging.

8. **Promotes sharing of knowledge:** E-resources also make it easier for users to collaborate, allowing them to share knowledge and complete projects collaboratively. Researchers can more easily cooperate on research projects and share knowledge because to the features that allow users to

share content, comment on publications, and access electronic databases and online libraries.

9. **Eco friendly:** Since e-resources eliminate the need for paper-based materials, they are also environmentally beneficial. This results in less energy being used to create and transport physical resources, as well as fewer trees being cut down to make paper. E-resources can be accessed numerous times without degrading or outgrowing their usefulness, making them more sustainable in the long run.

10. **Remote Access:** E-resources are available to everyone, regardless of their location or level of mobility. Users in remote or underserved locations can now more easily access information thanks to electronic databases and online libraries, which are accessible from anywhere in the world. Since many e- resources are made to be usable by people with hearing or vision impairments, they are also accessible to users with disabilities.

2.6 Disadvantages of E-Resources:

1. **Limited access:** Limited access is one of the main drawbacks of electronic resources. Electronic devices or the internet can be used to access e-resources, but not all users have access to either or the necessary electronic equipment. This implies that people without access to the internet or electronic gadgets cannot use e-resources. For those who reside in rural or distant places with limited access to the internet and electronic gadgets, this may be a considerable disadvantage. It can also be a difficulty for those who are financially unable to access the internet or purchase electronic equipment.

2. **Technical Issues:** Technical problems are a serious drawback of e-resources. The functionality of e-resources can be greatly impacted by technical issues because they are fully dependent on technology. Technical

issues, which might range from hardware failures to software bugs, can happen at any time. Downtime brought on by technical problems can also prohibit consumers from accessing e-resources when they're needed. For academics and students who significantly rely on e-resources to accomplish their work, interruption can be particularly challenging.

3. **Copyright and Licensing Issues:** Copyright and licencing concerns may restrict the accessibility and availability of e-resources. The amount of persons who can access certain publishers' materials may be constrained by the tight copyright limitations they impose. E-resources can become costly and out of reach for both individuals and organisations due to licencing difficulties. For those with tight budgets, both people and institutions, this may be a serious drawback.

4. **Quality Issues:** E-resources' usability and effectiveness may be constrained by quality issues. For instance, electronic books may have layout issues that make them challenging to read, while electronic journals may have defective search functionality. Quality issues may have an impact on the accuracy and dependability of online resources. For instance, researchers and students may be misled by incomplete or inaccurate information found in electronic databases.

5. **Security Risk:** E-resources' integrity and confidentiality are susceptible to security problems, which might jeopardise them. Malware or hacking attacks can damage sensitive data and personal information on e-resources. Intellectual property theft and the loss of vital research data are other consequences of security breaches. Institutions that store a lot of sensitive information may find security challenges to be especially difficult.

6. **Featured Gadgets for Accessibility:** The complete reliance of e-resources on electronic devices can be a serious drawback. Electronic equipment can be pricey, and for it to work effectively, it needs frequent maintenance and

upgrades. Dependence on electronics may also be a concern during crises when they may not be available, such as power outages. For people and organisations who rely largely on e-resources, this may be a serious disadvantage.

7. **Lack of Personal Interaction:** The level of personal engagement offered by traditional resources like books and print journals is higher than that offered by e-resources. Users of e-resources often access those using electronic devices, therefore they are unable to engage with tangible objects. People who like tangible things or who need to access materials that aren't available in electronic format may find this to be a drawback.
8. **Digital Divide:** The gap between individuals who have access to technology and those who do not is referred to as the "digital divide." E-resources can widen the digital divide by excluding people who don't have access to computers or other electronic devices. For those who are already struggling, this may present a serious disadvantage.

2.7 Various e-resources

1. **E-Book:** E-books is an abbreviated form for electronic books. They are electronic version of books which are made accessible through digital devices such as personal computers, tablets, mobile phones, etc. E-books can be downloaded from the internet or purchase directly from vendors. Portability is one of the most important characteristics of e-books, it can be easily carried around through handheld computers. E-books are subjected to multiple usage where one copy of e-book can be share by infinite numbers of users which also made it cost effective for libraries of any kind. Display, font size, font colour, etc. can be change according to the users' convenience which made it highly customizable. Some renowned global level e-books platform are:
    a) **KITABOO:** Kitaboo is a digital publishing platform and electronic

reading application developed by Hurix Systems Pvt. Ltd. It is created for the production and distribution of interactive digital content such as eBooks, eTextbooks, training materials, and other educational resources. Kitaboo provides multimedia integration, annotation tools, assessments, and analytics to publishers, authors, and learners. Kitaboo allows publishers and authors to transform print information into digital formats and augment it with multimedia components such as films, audio, and interactive quizzes. The platform supports a variety of file types, including PDF, ePUB, and HTML, which are designed to be compatible with a wide range of devices and operating systems. Kitaboo is a user- friendly Reader programme that can be accessed on desktops, tablets, and mobile devices. Users can download eBooks and access them offline. They can also annotate and highlight the text, look up specific passages, and interact with interactive features that are integrated into the digital content. Additionally, the platform enables functions like synchronised reading, which allows several users to read and work together on the same information at the same time. Organisations can build their own custom eBook shops or learning portals using the safe and adaptable platform provided by Kitaboo. Additionally, it offers analytics and reporting capabilities for monitoring learner progress, engagement, and performance. In general, Kitaboo is a comprehensive eReading and digital publishing system that attempts to turn conventional literature into interactive and interesting digital experiences.

b) **Amazon Kindle Direct Publishing (KDP):** Amazon Kindle Direct Publishing (KDP) is a self-publishing platform provided by Amazon.com in 2007. It makes it simple for writers and publishers to release their books in digital format for Amazon Kindle e-readers

and other gadgets that work with the Kindle app. Through Amazon's Kindle Store, authors may reach millions of prospective readers worldwide by uploading their manuscripts, producing electronic versions, setting prices, and using KDP to distribute their books. The platform has an intuitive user interface and offers a number of tools and resources to help authors format their books, create covers, and improve their metadata.

c) **Apple iBooks Store:** The Apple iBooks Store, now known as Apple Books, is an online platform where you can purchase and download digital books to read on Apple devices such as iPhones, iPads, and Macs. There is a huge selection of e-books available, including bestsellers, timeless works, textbooks, and more. You can either utilise the "Books" app that comes pre-installed on your Apple device or go to the Apple Books website to access the Apple Books Store. From there, you may check book descriptions, read reviews, and place orders while browsing through numerous categories and genres. With features like customised fonts, changeable text sizes, bookmarks, highlighting, and notes, Apple Books offers a user-friendly reading experience. Additionally, it allows you to start reading on one device and continue smoothly on another by syncing your progress between devices. Apple Books sells books, but it also provides a variety of free e-books, samples, audiobooks, and interactive books.

d) **Barnes & Noble Press:** Barnes & Noble Press is a self-publishing platform provided by Barnes & Noble, one of the largest retail booksellers in the United States. It allows authors to publish and sell their books in both print and digital formats. The platform, which was formerly known as Nook Press, changed its name to Barnes & Noble Press in 2018. It provides authors with a variety of

resources and services to help them write, publish, and market their books. These consist of tools for promotion, cover design, and manuscript preparation. Authors can establish prices, make book covers, upload their writings, and select distribution methods. If the author selects the right distribution channels, books are made available for purchase after publication on the Barnes & Noble website, as well as through other online retailers and in actual Barnes & Noble shops. Barnes & Noble offers reporting and payment services for authors who wish to receive royalties from book sales. Through its online "NOOK" platform, Barnes & Noble sells eBooks. They offer access to a huge library of eBooks, periodicals, newspapers, and other digital content through NOOK, their digital reading service. Users can buy and download eBooks with a NOOK account to read on their NOOK e-Reader devices or using the NOOK app, which is accessible for a variety of platforms including smartphones, tablets, and PCs. To view the eBooks available, go to the Barnes & Noble website and select the NOOK area. They offer a large selection of books in numerous genres, such as self-help, fiction, non- fiction, bestsellers, and more. They frequently provide special eBooks and discounts to NOOK users as well.

e) **Kobo Writing Life:** KOBO Writing Life is a self-publishing platform specifically designed for authors who want to publish their books digitally and reach a wide audience. The Canadian e-book and e-reader business Kobo offers it as an online publishing site. Authors can publish their books as e-books using KOBO Writing Life and have them distributed all around the world via Kobo. It provides an easy method for authors to upload and prepare their manuscripts, create book covers, establish prices, and select

distribution channels. Through the dashboard of the site, authors may also keep track of their sales and royalties.

f) **Draft2Digital:** Draft2Digital is a self-publishing platform that helps authors and independent publishers distribute their e-books to various online retailers. By offering a single platform where authors can upload their manuscript and cover files and subsequently convert them into numerous e-book formats compatible with different e-readers and devices, it streamlines the e-book distribution process. By automating the conversion process and providing a user-friendly interface, Draft2Digital saves authors the bother of formatting their books for various e-book platforms. Draft2Digital can transform the work into well-liked e-book formats including e-Pub, MOBI, and PDF once it has been uploaded. Using Draft2Digital has a lot of benefits, including its distribution network. The platform has agreements with several e-book stores and online retailers. Without having to submit their novels to each retailer separately, authors can make their books accessible for purchase on a variety of platforms by publishing through Draft2Digital. Additionally, it offers other helpful tools including the ability to manage author profiles, access sales reporting and analytics, and the opportunity to schedule pre-order dates for upcoming releases. Additionally, it provides marketing tools like universal book links, which enable authors to distribute a single link that, depending on the reader's location, takes them to the book's page on the website of the suitable retailer.

g) **Lulu:** Lulu is an online self-publishing platform that allows authors to publish and distribute their books in both print and ebook formats. While Lulu initially gained popularity as a print-on-

demand service, it has expanded its offerings to include ebooks as well. Here's how the process typically works for publishing ebooks on Lulu:

i. **Create an account:** Visit the Lulu website (www.lulu.com) and create a free account. You'll need to provide some basic information and set up your author profile.

ii. **Prepare your ebook:** Before uploading your ebook to Lulu, ensure that it is properly formatted and converted into a suitable file format, such as EPUB or PDF. You may use tools like Calibre or professional ebook formatting services to ensure your book meets the required standards.

iii. **Upload your ebook:** Once your account is set up, you can upload your ebook file through the Lulu website. Follow the instructions provided to complete the upload process. Lulu will guide you through the necessary steps, including entering book details, cover design, and pricing options.

iv. **Set pricing and royalties:** Lulu provides options for setting the price of your ebook. You can choose from a range of pricing tiers and royalty options. Keep in mind that Lulu takes a percentage of the sale price as their commission, so consider this when determining your pricing strategy.

v. **Review and publish:** After you've uploaded your ebook and set the necessary details, Lulu will generate a preview of your ebook for you to review. Make sure to thoroughly review the content, formatting, and cover design before proceeding.

vi. **Distribution options:** Lulu offers various distribution options for ebooks. You can choose to make your ebook available for

sale directly on Lulu's website, and you also have the option to distribute it to major ebook retailers like Amazon Kindle, Apple iBooks, and Barnes & Noble Nook. Select the distribution channels that suit your publishing goals.

vii. **Publish and promote:** Once you're satisfied with the preview and distribution settings, you can proceed to publish your ebook. Lulu will make your ebook available for sale according to your chosen distribution options. It's important to promote your book independently to increase its visibility and reach potential readers. It's worth noting that Lulu operates on a self-publishing model, which means you retain the rights to your work and are responsible for marketing and promotion. Lulu provides the platform and distribution channels for your ebook, but the success of your book largely depends on your efforts to reach your target audience.

2. **E-Journal:** E-journal is also called electronic journals, unlike printed journals they are published in the virtual domain. E-journals scores over printed journals in many ways. Articles in e-journals can be searched and locate easily using computers. Hypertext links provided within the journals can be used to locate related topics. The idea for e-journals were made since the use of computers for scholarly publication. The first scholarly e-journal can be date back to 1979 (Hans, 1995). Some of the most renowned publishers of e-journals are:

   a) **Springer Nature:** As a pioneer in open research, Springer Nature publishes some of the most prestigious e-journals in the world. All sound research can find a home here, and some of the most significant modern discoveries have been made on its foundation since it spans the entire spectrum of research disciplines (Springer

Nature, 2023). Articles on Springer Nature are published online through three platforms:

i. Springerlink.com: It covers thousands of titles tailored to each field, including those with the Springer, Palgrave Macmillan, and Adis labels, it covers the full range of science, technology, medicine, and social sciences.

ii. Nature.com: It provides high impact reviews of respective disciplines through prestigious multi-disciplinary publications from Nature Portfolio and a range of discipline-specific academic journals, covering the cutting edge of science, technology, and medicine.

iii. BioMedCentral.com: It provides large amount of highly scholastic peer reviewed open access journals.

b) **Elsevier:** Elsevier is a Dutch academic publishing house that specialises in content pertaining to technical, scientific, and medical. The Lancet, Cell, Trends, the Current Opinion series, the online citation database Scopus, the SciVal tool for assessing research performance, the ClinicalKey search engine for clinicians, and the ClinicalPath evidence- based cancer care service are just a few of its publications. Digital tools for data administration, education, research analytics, and assessment are among Elsevier's offerings (Elsevier, 2023).

i. **John Wiley & Sons**: The American international publishing company John Wiley & Sons Inc., also known as Wiley, was established in 1807 with a concentration on scholarly publications and educational products. For undergraduate, graduate, and continuing education students, the corporation

publishes books, journals, and encyclopaedias both in print and electronically. It also offers online products and services, training resources, and educational materials. The business was founded in 1807, and it published notable American authors of the 19th century. In 1865, the company adopted its current name. Later, Wiley abandoned its literary pursuits and moved its attention to scientific, technical, and engineering subject areas. The corporation grew its publishing endeavours, scientific endeavours, and higher education throughout the 20th century.

ii. **Harvard University Press:** The Black Atlantic by Paul Gilroy, The Structure of Evolutionary Theory by Stephen Jay Gould, The Bible As It Was by James Kugel, Toni Morrison's Playing in the Dark, Capital in the Twenty-First Century by Thomas Piketty, A Theory of Justice by John Rawls, On Human Nature by E. O. Wilson, and The Art of Shakespeare's Sonnets by Helen Vendler are just a few of the classics published by Harvard University Press, which was founded in 1913. It provide books from famous specialists and up-and-coming authors who are rethinking entire disciplines of study for general readers as well as scholarly and professional audiences. Our dedication to publishing works in translation is demonstrated by an unrivalled variety of series that offer bilingual editions of world classics, headed by the Loeb Classical Series. The Board of Directors of Harvard University Press is responsible for the review and control of the business affairs of the Press. The board is composed of university administrators and faculty, along with publishing executives who are neither faculty nor employees of Harvard University (Harvard University Press, 2023).

iii. **Cambridge University Press:** The Cambridge University Press

was established in 1534 after Henry VIII gave the university the authority to produce any kind of book. The Press is the world's oldest publishing firm after releasing its first book in 1584. The Press gained a reputation for competence in scholarly publication of academic literature, poetry, schoolbooks, prayer books, and Bibles during the course of the following four centuries, spreading throughout Europe. The Press published groundbreaking works such Philosophiae Naturalis Principia Mathematica by Isaac Newton, Lycidas by John Milton, Radio-activity by Ernest Rutherford, and Language and Mind by Noam Chomsky. The Press expanded its reach in the 20th century to become a global publisher, and it is continuing expanding in the 21st, providing millions of thoughts on countless topics to the world.

iv. **Taylor & Francis:** Taylor & Francis has devoted itself entirely to the publication of scholarly works of the highest calibre for more than two centuries. When Richard Taylor introduced the Philosophical Magazine in 1798, he created the groundwork for the business. It served as the beginning of a great deal of further tight relationships with academic societies. When Dr. William Francis, a chemist, joined Richard Taylor in 1852, he carried on the longstanding relationship between the academic world and the business. Taylor & Francis was transformed into a private limited corporation in 1936 with eminent scientists serving as directors and shareholders. More than 2,700 journals are collected by Taylor & Francis Online, including CogentOA, a collection of broad-spectrum open access journals, the world's largest programme of Social Science and Humanities journals published by Routledge, and cutting-edge theoretical and

applied Science, Technology, and Medical content from Taylor & Francis. Open access and more conventional subscription publishing options are supported by the journals on this platform. DovePress is a peer-reviewed journal publisher that specialises in open access publication with a concentration on publishing medical articles. The open access platform F1000Research challenges conventional wisdom regarding how research should be disseminated. Its guiding principle encourages researchers to share their whole body of work, including null results, data notes, and more. The F1000 Research procedure enables open and transparent communication between authors and reviewers from beginning to end (Taylor and Francis, 2023).

3. **Websites:** Website is an ensemble of connected web pages under a single domain name, often created by a single person or organisation. Websites are becoming an indispensable component of modern life, giving users access to a wide range of services and knowledge. In terms of design website can be categorised into three broad group, such as:

    a) Static Website: Static website are those website whose content remain static and unchanged. A static design is ideal designing few pages on website and do not require the data to be updated. The information on a static site remains the same and does not change over time. HTML, CSS, and Java are used to create static webpages. They are simple to develop and search engines may easily identify them. However, they may be least competent for integrating complicated features and high functionality within the webpage. Another big challenge is that static webpages must be manually updated. It is a time-consuming and laborious task.

b) Dynamic Website: Dynamic website contains dynamic information in its page. Dynamics website can be update both automatically depending on set of criteria maintained by the developers. Content Management Systems (CMS) such as Wordpress, Jhoomla, etc. are used to developed dynamic websites. One of the major setback of dynamic websites is its complexity of creation.

4. **E-Newspaper:** E-newspapers are also referred to as digital newspapers they are electronic publications of printed newspapers which can be read on computers, tablets, and smartphones. They are digital reproductions of printed publications. E-newspapers are normally accessible through specialised e- newspaper programmes or through the websites of newspaper companies. E- newspapers scores over their printed counterparts in a number of ways. Since they don't need paper or ink, they are frequently less expensive and more environmentally friendly than print newspapers. Additionally, e-newspapers are more practical because they can be accessed from any location with an internet connection and are simple to search and navigate. The concept of e- newspaper does not mandate to the creation of all printed version of newspapers in digital version text format, e-newspapers may exist in the form of applications or any other software as well or even websites.
5. **E-Magazines:** E-magazines, usually referred to as digital magazines, are periodicals created specifically to be read on computers, tablets, and other electronic devices. E-magazines, in contrast to traditional print magazines, contain interactive elements like videos, audio, and hyperlinks and can be delivered and viewed with ease through a variety of digital platforms. Due to their accessibility, affordability, and convenience, e-magazines are growing in popularity. E-magazines are simple for readers to download and store on their electronic devices, allowing for anytime, anywhere access. E-magazines can also be more cost-effective and environmentally

friendly than print magazines because they don't use paper or ink. A lot of publishers now provide digital subscriptions in addition to print editions of their periodicals. News, sports, entertainment, fashion, lifestyle, and other themes are all covered in e-magazines. The New Yorker, Wired, National Geographic, and Vogue are a few well-known e-zines.

6. **Indexing and Abstracting Databases:** These are those database which provided indexes and abstracts of literature to its users, the main purpose of indexing and abstracting database is to create efficient search and retrieval service. A database that can be searched and contains data on the content of a group of documents is called an indexing database. In order to define the content of each document in the collection, a list of terms also referred to as keywords must be created. Then, based on the content of the documents, these terms are utilised to generate an index that enables users to search for certain documents. Many libraries, archives, and other collections of documents employ indexing databases. A database that summarises the content of a group of documents and makes it searchable is called an abstracting database. A document's major points are summarised in an abstract, enabling users to decide quickly whether a document is pertinent to their research. Academic researchers frequently use abstracting databases when they need to swiftly find pertinent articles among a huge number of publications. Some of the most renowned indexing and abstracting databases are:

    a) Web of Science by Clarivate analytics
    b) Scopus by Elsevier
    c) MEDLINE by US National Library of Medicine
    d) Pub Med Central by NCBI
    e) Directory of Open Access Journals
    f) Ei Compendex

g) Google Scholar

7. **Full text database:** Full-text database are electronic database which holds the entire text of books, papers, and other written works as opposed bibliographic data or abstracts. In addition to libraries and other organisations that need access to substantial collections of written works, these databases are frequently used in academic and research settings. Full-text databases are searchable which enable users to find particular pieces of information inside the database. In order to make it simpler to access and retrieve information, they might be categorised according to the topic, author, publication date, or other factors. Many full-text databases additionally offer extra features including tools for organising and preserving search results, citation information, and links to relevant related literature. Academic research databases like JSTOR and ProQuest, as well as specialised databases for particular subjects like PubMed for biomedical research and Scopus for science and technology, are a few examples of full-text databases. These databases are available to users for research and other uses because to the subscriptions that many libraries and other institutions have to them.

8. **Reference database:** A reference database is a set of data or information that has been compiled, updated, and maintained for use in study and reference. These databases are used by researchers, academics, students, and professionals to obtain information and assist their work since they often contain comprehensive and detailed information on a single topic or a range of topics. Reference databases include the following:

    a) Library catalogues: These databases offer information about books, periodicals, and other library products.

    b) Online reference sources: Online encyclopaedias, dictionaries, and

other sites that provide knowledge on a variety of subjects are examples of online reference resources.

c) **Databases of scholarly publications:** research papers, and other academic materials are examples of research databases.

d) **Government databases:** These are databases maintained by government agencies that provide information on a wide range of topics, including demographic data, economic statistics, and environmental data.

e) **Medical databases:** It includes medical research databases, patient information databases, and other medical data databases.

f) **Legal databases:** It is a collection of court decisions, precedents, and other legal information.

9. **Statistical database:** A statistical database is a collection of data that has been organised and analysed to offer information on a certain subject or range of subjects. It often contains data acquired through surveys, studies, or other research methods and is organised in such a way that it can be retrieved and analysed efficiently. Statistical databases are often used in sectors such as economics, social sciences, and public health, where enormous amounts of data must be analysed in order to discover patterns and trends. In business and marketing, they are also used to analyse customer behaviour and market trends. Statistical databases frequently make use of statistical software to organize and analyse data. This software can be used to create charts, tables, and graphs that show data patterns and trends. Statistical databases are utilized extensively in a wide range of industries, including government, industry, healthcare, and education.

10. **CD/DVD ROMS:** CD-ROMs and DVD-ROMs are optical storage media for storing and retrieving data. CD-ROMs can hold up to 700 MB of data,

but DVD-ROMs can hold up to 4.7 GB on a single-layer disc or 8.5 GB on a dual- layer disc.CD-ROMs and DVD-ROMs read data from the disc using a laser beam. The laser beam reflects off the disc and is picked up by a sensor, which turns the signal into digital data that a computer can read.CD-ROMs and DVD- ROMs are commonly used for programme installation, data backup, and multimedia content. However, as digital downloads and online streaming become more prevalent, physical discs such as CD-ROMs and DVD-ROMs are becoming less widespread. There are several important use for CD/DVD ROM in a library, it can be used to access a wide variety of multimedia assets, including instructive videos, documentaries, and music albums, and it can also be used for back up of several library resources and records. Oral histories, ancient films and documentaries, and other items that are difficult to acquire or preserve using traditional techniques can be archived on CDs and DVDs.

11. **E-Thesis/Dissertations:** A digital version of a thesis or dissertation that is submitted and maintained electronically is known as an e-thesis or e-dissertation. Rather than printing and submitting a physical copy of the thesis or dissertation to the university, the electronic version is submitted online. This electronic version can be saved in a digital repository for later use, making it easily accessible to scholars, academics, and the general public. Many colleges now require students to submit their theses and dissertations electronically, and some even demand the final work to be published in an open access repository. This increases the visibility and diffusion of research, potentially leading to greater impact and recognition. Students often use a word processing programme to produce their document and then convert it to a PDF or other digital format to prepare an e-thesis or e-dissertation. The material should be correctly organised and structured in accordance with the university's criteria. It is also critical to add any relevant supplementary elements in the electronic edition, such

as graphs, tables, or photographs. Overall, submitting and storing crucial academic research via e-thesis or e-dissertation is a convenient and efficient method. It enables for greater distribution of the work and aids in its preservation for future generations.

12. **E-Reports:** Electronic reports, or e-reports, are documents that are generated and transmitted electronically. They can take many different formats, including PDF documents, spreadsheets, and other electronic files. E-reports have grown in popularity in recent years due to various advantages over traditional paper- based reports. They are, for example, easier to make and disseminate because they can be emailed or published to a website. They are also more environmentally friendly because they do not require paper or ink. E-reports are utilised in a variety of industries and contexts, including as business, government, education, and healthcare. They can be used to convey a wide range of information, including financial reports, research findings, and status updates.

13. **E-Clipping:** E-clippings, or electronic clippings, are digital versions of articles, news pieces, or other written content. These clips can be stored, organised, and shared using a variety of digital tools, including bookmarking apps, RSS feeds, and social media platforms. Because of the simplicity with which they can be viewed and shared, e-clippings have grown in popularity in recent years. We will look at the benefits of e-clippings and how they can be utilised in research, journalism, and personal knowledge management in this post. E-clippings, also known as electronic clippings, are digital reproductions of articles, news items, and other textual content. A range of digital technologies, such as bookmarking apps, RSS feeds, and social media platforms, can be used to store, organise, and distribute these clips. E-clippings have gained in popularity in recent years due to the ease with which they can be seen and shared. In this piece,

we will look at the benefits of e-clippings and how they may be used in research, journalism, and personal knowledge management. E-clippings are very valuable for researchers because they provide quick access to a wide range of material on a certain topic. Researchers can collect relevant articles and news stories as they are published by using bookmarking tools or RSS feeds. This can help researchers stay current on the newest advancements in their field, helping them to stay ahead of the curve and make better educated decisions. Journalists can profit from e-clippings as well, as they can be used to swiftly acquire background material on a certain story. Journalists can gather pertinent articles and news stories on a specific topic by using bookmarking tools or social media platforms, providing them with a full perspective of the issue at hand. Furthermore, e-clippings can help journalists avoid overlooking vital material that could be pertinent to their narrative. There are numerous tools available for collecting and organising e-clippings. Bookmarking tools like Pocket and Instapaper enable users to bookmark articles and news stories with a few clicks, whereas RSS feeds enable users to receive updates on a specific topic as new articles are released. Twitter, for example, can be used to gather e-clippings because users can save articles and news stories by liking or retweeting them.

14. **E-Patents:** Patents that are filed and administered electronically are referred to as electronic patents or e-patents sometimes known as e-patents. E-patents have grown in popularity in recent years due to the advantages they provide in terms of speed, efficiency, and cost-effectiveness. In this post, we'll look at the advantages of e-patents and how they're altering the patent application process. One of the most significant advantages of e-patents is their speed and efficiency. Applicants can save a significant amount of time by filing patents electronically as opposed to traditional paper-based applications. E-patent applications can be filed 24 hours a day,

seven days a week from anywhere in the world, eliminating the requirement for physical documents to be shipped or couriered. This implies that applicants can file their applications as soon as they are finished, rather than waiting for materials to arrive in the mail. Another advantage of e-patents is their low cost. Because they do not necessitate the same degree of physical materials and transportation costs as traditional paper- based patents, e-patents are frequently less expensive. Furthermore, the electronic filing procedure is often more streamlined and efficient, which can result in decreased legal fees and other patent application costs. E-patents also provide greater accuracy and completeness than traditional paper-based applications. Electronic filing systems frequently include error checking and validation capabilities that can assist in identifying potential flaws or inconsistencies in the application prior to filing. This can help to limit the amount of rejections or objections issued by the patent office, thereby saving applicants time and money. In addition, e-patents are easier to maintain and track than traditional paper-based applications. Electronic filing methods give applicants real-time updates on the status of their application, including any objections or rejections from the patent office. This allows applicants to respond to objections or rejections more rapidly, resulting in a faster and more successful patent application. Despite the numerous advantages of e-patents, there are some potential downsides to be aware of. There is a danger, for example, that electronic systems will be hacked or compromised, resulting in the theft or misuse of sensitive information. Furthermore, some patent offices may lack the infrastructure or resources to handle electronic filing methods, which could result in application delays or other complications.

15. **E-Standards**: E-standard refers to a set of standards used to ensure the quality, safety, and compatibility of electronic devices and equipment. These standards are essential to the development, manufacture, and

distribution of electronic products across different countries and regions. E-standards cover a wide range of technical areas, including electrical and electronic components, electromagnetic compatibility, telecommunications, and information technology. The need for e-standards emerged as electronic devices became increasingly prevalent and important in everyday life. The rapid pace of technological development also meant that new electronic products were being introduced at an unprecedented rate. As a result, there was a growing need for common technical standards to ensure that electronic devices could be manufactured and used safely and efficiently. One of the most significant e- standards is the International Electro-technical Commission (IEC) 60065 standard, which covers the safety requirements for audio, video, and similar electronic equipment. This standard specifies various tests that electronic equipment must pass before it can be sold, such as tests for electrical insulation, fire resistance, and protection against electric shock. Another important e- standard is the IEC 60601 standard, which covers the safety and performance requirements for medical electrical equipment. This standard is particularly important for ensuring that medical devices are safe to use and do not pose a risk to patients or healthcare professionals. In addition to safety standards, e- standards also cover technical requirements for electronic devices, such as electromagnetic compatibility (EMC) standards. EMC standards specify the levels of electromagnetic interference that electronic devices must be able to withstand, as well as the levels of electromagnetic emissions that they can produce. Telecommunications standards are another important area of e- standards, covering everything from mobile networks and internet protocols to satellite communication systems. These standards are essential for ensuring that electronic devices can communicate with each other effectively and efficiently. One of the challenges of e-standards is that they

need to be updated regularly to keep up with the rapid pace of technological change. As new electronic products are developed, existing standards may need to be revised or new standards created to address emerging issues. Another challenge is ensuring that e-standards are adopted and implemented consistently across different countries and regions. This requires collaboration between different stakeholders, including governments, industry bodies, and standards organizations. Despite these challenges, e-standards play a crucial role in ensuring the safety, quality, and compatibility of electronic devices and equipment. They provide a common framework for manufacturers, regulators, and consumers to work within, ensuring that electronic products can be manufactured, sold, and used with confidence.

2.8 Indian Initiatives in Formulating E-Resources.

Several initiatives has been taken by the Indian government in order to promote e-resources in the country. The preamble of National Policy on ICT in School Education by MHRD (2012) said that, "The National Policy on Education 1986, as modified in 1992, stressed the need to employ educational technology to improve the quality of education. The policy statement led to two major centrally sponsored schemes, namely, Educational Technology (ET) and Computer Literacy and Studies in Schools (CLASS) paving the way for a more comprehensive centrally sponsored scheme – Information and Communication Technology at Schools in 2004. Educational technology also found a significant place in another scheme on upgradation of science education. The significant role ICT can play in school education has also been highlighted in the National Curriculum Framework 2005 (NCF) 2005. Use of ICT for quality improvement also figures in Government of India's flagship programme on education, Sarva Shiksha Abhiyan (SSA). Again, ICT has figured comprehensively in the norm of schooling recommended by the Central Advisory Board of Education (CABE), in its report on Universal Secondary Education, in 2005. With the convergence of

technologies, it has become imperative to take a comprehensive look at all possible information and communication technologies for improving school education in the country. The comprehensive choice of ICT for holistic development of education can be built only on a sound policy. The initiative of ICT Policy in School Education is inspired by the tremendous potential of ICT for enhancing outreach and improving quality of education. This policy endeavours to provide guidelines to assist the States in optimizing the use of ICT in school education within a national policy framework."

As given in the preamble in the National Policy on ICT in School education it can be witnessed that the policy makers of India have long foreseen that the future of the nation's education system heavily depends on its utilization of ICT.

National Mission on Education through ICT (NMEICT) was one of the major initiatives taken towards implications of ICT in education by India. The Mission Documents of NMEICT published by MHRD (2009) clearly states that "For India to emerge as a knowledge super power of the world in the shortest possible time it is imperative to convert our demographic advantage into knowledge powerhouse by nurturing and honing our working population into knowledge or knowledge enabled working population." This statements clearly shows that India is in the process to change is demographic advantage to become a knowledge super power. On its webpage NMEICT (2023) states that:

> *"The National Mission on Education through Information and Communication Technology (ICT) has, under its aegis, created Virtual Labs, Open Source and Access Tools, Virtual Conference Tools, Talk to Teacher programs, a Non- Invasive Blood Glucometer and also for simulated lab experiments, a Di. Electric frequency shift application development of resonator for low cost oscillators. The National Mission on Education through Information and Communication Technology (ICT) has been envisaged as a Centrally Sponsored Scheme to leverage the*

potential of ICT, in providing high quality personalized and interactive knowledge modules over the internet/intranet for all the learners in Higher Education Institutions in any time anywhere mode. This is expected to be a major intervention in enhancing the Gross Enrolment Ratio (GER) in Higher Education by 5 percentage points during the XI Five Year Plan period and in ensuring access and equity in Higher Education. The Mission has two major components viz., (a) content generation and (b) connectivity along with provision for access devices for institutions and learners. It seeks to bR&Dge the digital divide, i.e., the gap in the skills to use computing devices for the purpose of teaching and learning among urban and rural teachers/learners in Higher Education domain and empower those, who have hitherto remained untouched by the digital revolution and have not been able to join the mainstream of the knowledge economy. It plans to focus on appropriate pedagogy for e-learning, providing facility of performing experiments through virtual laboratories, on-line testing and certification, on- line availability of teachers to guide and mentor learners, utilization of available Education Satellite (EduSAT) and Direct to Home (DTH) platforms, training and empowerment of teachers to effectively use the new method of teaching learning etc. On the one hand, the Mission would create high quality e-content for the target groups and on the other, it would simultaneously seek to extend computer infrastructure and connectivity to over 18000 colleges in the country including each of the departments of nearly 400 universities/deemed universities and institutions of national importance. The peer group assisted content development would utilise the Wikipedia type of collaborative platform under the supervision of a content advisory committee responsible for vetting the content. Interactivity and problem solving approach would be addressed through "Talk to a Teacher" segment."

The key objectives of NMEICT are as follows:

1. **E-Content Development:** NMEICT focuses on developing high-quality e- content in various formats, including text, audio, video, and multimedia, covering a wide range of subjects and educational levels. The mission emphasizes creating digital resources that are accessible, interactive, and pedagogically effective.
2. **Virtual Labs:** The mission aims to establish virtual laboratories to provide students with practical learning experiences in science and engineering disciplines. Virtual labs enable students to conduct experiments online, helping them understand and apply theoretical concepts in a virtual environment.
3. **Connectivity:** NMEICT promotes the establishment of high-speed internet connectivity in educational institutions across the country. It facilitates network infrastructure development, including the National Knowledge Network (NKN), to connect schools, colleges, universities, and research institutions, enabling seamless communication, collaboration, and access to digital resources.
4. **ICT Infrastructure:** The mission supports the creation of ICT infrastructure in educational institutions, including the establishment of computer labs, smart classrooms, and e-learning facilities. It aims to equip institutions with the necessary hardware, software, and networking infrastructure to integrate ICT effectively into teaching and learning processes.
5. **Capacity Building:** NMEICT emphasizes capacity building programs for teachers, administrators, and educational stakeholders to enhance their ICT skills, knowledge, and pedagogical practices. It conducts training workshops, seminars, and online courses to empower educators to effectively utilize digital tools and resources in their teaching methods.
6. **Research and Development:** The mission encourages research and

innovation in the field of ICT in education. It supports research projects, collaborations, and pilot initiatives to explore emerging technologies, pedagogical approaches, and best practices in integrating ICT for educational improvement.

NMEICT has made significant contributions to the Indian education system. It has facilitated the creation of an extensive repository of e-content through initiatives like the National Digital Library (NDL), e-PG Pathshala, and e-Content Development and Dissemination. The mission has also helped establish virtual labs in science and engineering disciplines, providing students with hands-on learning experiences. Additionally, NMEICT has improved connectivity and ICT infrastructure in educational institutions, enabling access to digital resources and promoting e-learning practices.

2.8.1 Role of INFLIBNET in promoting e-resources:

INFLIBNET (Information and Library Network) is an autonomous Inter-University Centre (IUC) and a specialized agency that plays a crucial role in providing e-resources to academic and research institutions in India. Some key aspects of the role of INFLIBNET in providing e-resources:

1. **E-Consortium:** E-Consortium is an online collectivity of institution with common interest for knowledge sharing. INFLIBNET hosted such consortium like, e-ShodhSindhu, Shodh Suddhi, NLIT, Infistat, etc.

2. **Open Access Facilities:** INFLIBNET provide open access facilities of scholarly content such as Shodh Ganga, Shodh Gangotri, Shodh Chakra, INFLIBNET IR and INFOPORT.

3. **Project and Services:** INFLIBNET centre initiated important project and services such as e-PGpathshala, Vidwan Database, Vidya Mitra and IRINS

4) **Library Automation:** The centre has helped several academic libraries

within the country by providing SOUL automation software and IndCat a Union Catalogue.

Image 3: Homepage of INFLIBNET Website

2.8.2 E-Resources remote accessing tools and methods:

Accessing e-resources involves different tool and method based on the types of e-resources the user intend to access. Methods of accessing e-resource are also determined by the institutions or providers which offer the service. Some common tools and method of accessing e-resource include.

1. **Library Database**: Library database is one of the most common platforms for accessing e-resources in the academic community. Library database is mainly provided through library website. Many universities provided access to e- resource through library website or webpage. Library website also provide library catalogue which is used to access various collections of the library.

2. **Database Platform**: There are several e-resources which can be accessed through online database such as EBSCO, Jstor, ProQuest, etc. These platforms provide different accessing methods and policy. Accessing this database is mainly provided through subscription. However, there are

several database which offers open access such as DOAJ, DOAR, etc.

3. **E-books platform**: There are several platforms which is dedicated for accessing e-resources e.g. Amazon Kindle and Anybooks. These platforms provide e-books off all types. There are several e-books platform which exist as application software which is compatible to all types of operating software while other are provided through websites. E-Books platform are mainly subscription based but there are several platforms which are free for all types of users e.g. Project Guttenberg.

4. **Remote Access**: There are several software which provides remote access to library e-resources. Use of these software enable user to utilise library resources from remote location without physically present in the library. Some remote access software are:

   i. **Knimbus**: Knimbus is a cloud based digital library platform where all library online resources can be made available in one platform. Providing access to subscribed content, web OPAC and institutional repository.

   ii. **RemoteXS**: RemoteXS is a cloud based service that provides a single portal for accessing a variety of e-content, the allocation of fixed IP addresses for institutions and usage statistics for all e-resources. RemoteXS can be used on variety of devices, including tablets and smartphones.

   iii. **Ezproxy's**: Ezproxy is a web proxy server used by libraries to give access from outside the library's computer network to restricted access website that authenticate users buy IP address. Ezproxy allows library users at remote locations to log in through their library's Exproxy server and gain access to resources to which their library subscribes.

2.9 Conclusion

In conclusion, electronic resources have undeniably transformed the way we access and interact with information, revolutionizing education and research. The accessibility, speed, and democratization of knowledge that electronic resources offer are unparalleled. However, challenges such as the digital divide and privacy concerns must be addressed to ensure that the benefits of electronic resources are accessible to all, fostering a more inclusive and equitable knowledge society. As technology continues to advance, the role of electronic resources in shaping the future of education and information access will undoubtedly evolve, and society must adapt to harness the full potential of these transformative tools.

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1.1 ntroduction:

Information and Communication Technology" (ICT) refers to the use of technology for information processing and communication. It includes a wide range of technologies that make it possible for people and businesses to generate, save, retrieve, manipulate, and send information electronically. Computers, software, networks, the internet, mobile devices, and other digital tools are some examples of these technologies. The way we communicate, work, and live has changed as a result of ICT. In the past, letters, phone conversations, and face-to-face contacts were frequently the only forms of communication. We now have access to a wide variety of communication channels that allow us to communicate with individuals from all over the world in real-time thanks to the development of the internet and mobile technology. Social media sites like Facebook, Twitter, and Instagram have proliferated, allowing users to interact with friends and family, share ideas, and even create online communities. The influence of ICT at work has been particularly notable. ICT has completely changed how firms run, streamlining procedures and boosting productivity. The use of digital tools like cloud storage, project management software, and video conferencing platforms has improved team collaboration even when members are dispersed around the globe. Due to this, flexible work schedules and remote employment have become more popular, enabling employees to do their work while travelling or at home. The field of education has also been revolutionised by ICT. Students now have access to a multitude of knowledge and services that were previously unavailable because to the rise of digital devices and platforms. Through online learning platforms like Coursera and edX, people may enrol in classes at prestigious colleges all around the world, frequently at no cost. Because of this, education is now more open to people from various backgrounds. ICT has a lot to offer, but it also comes with some risks and concerns. The gap between those who have access to digital technologies and those who do not is one of the major concerns, and it is known as the "digital divide." Both industrialised and developing nations

exhibit this divide, where access to technology and levels of digital literacy differ significantly. Another significant ICT challenge is cybersecurity. Because of the development of digital technology, there is now a much greater risk of cyberattacks and data breaches. Hackers and other cybercriminals have the ability to breach computer systems, steal critical data, and create extensive disruption. ICT has completely changed the way we communicate, work, and interact, allowing us to connect with people around the globe and have access to a multitude of knowledge and resources. It does, however, also present some difficulties and dangers, such as the digital divide and cybersecurity hazards. It is crucial that people and organisations learn the abilities and approaches required to utilise ICT in a secure, responsible, and beneficial way as technology continues to advance.

1.2 Meaning and Scope of Information and Communication Technology (ICT)

According to UNESCO (2023) Diverse set of technological tools and resources used to transmit, store, create, share or exchange information. These technological tools and resources include computers, the Internet (websites, blogs and emails), live broadcasting technologies (radio, television and webcasting), recorded broadcasting technologies (podcasting, audio and video players and storage devices) and telephony (fixed or mobile, satellite, visual/video-conferencing, etc.).

According to Pratt (2019) ICT or information and communications technology is the infrastructure and components that enable modern computing. Although there is no single, universal definition of ICT, the term is generally accepted to mean all devices, networking components, applications and systems that combined allow people and organizations (i.e., businesses, non-profit agencies, governments and criminal enterprises) to interact in the digital world. Rouse (2023) defines that, “Information and Communications Technology (ICT) is the use of computing and telecommunication technologies, systems and tools to facilitate the way information is created,

collected, processed, transmitted and stored. It includes computing technologies like servers, laptop computers and software applications, as well as the wired and wireless communication technologies that support telephones, the Internet, the Internet of Things (IoT) and the metaverse. The goal of ICT is to improve access to information and make human-to-human, human- to-machine and machine-to-machine (M2M) communication easier and more efficient."

A frequently visited webpage Unacademy (2022) frames that, "Although there is no specific definition that can define the term ICT, it is an extensional term for information technology (IT) which mainly focuses on the role of unified communications and integrated with telecommunications which includes telephone lines & wireless signals and computers. It also comprises all the software, audio, visual, middleware and storage that helps users to store, transmit, access and understand information and manipulate it according to their needs. ICT also includes the merger of telephonic communication, audio and visual networks with computer system networks by the use of a single cable or any link system. ICT is a broader term that includes all the communicational devices, cell phones, radio, television, and computer along with satellite systems. Various services and appliances such as video conferencing and distance learning programmes are also included in ICT with analogue technology."

1.3 Components of Information and Communication Technology (ICT)

Pratt (2019) opines that, ICT includes both the internet-enabled world and the mobile world powered by wireless networks. It also contains outdated technologies like as landline telephones, radio and television broadcasting, which are still widely utilised today with cutting-edge ICT components such as artificial intelligence and robotics.

ICT and IT (for information technology) are often used interchangeably; however, ICT is generally used to signify a broader, more

comprehensive list of all components connected to computer and digital technologies than IT. The list of ICT components is exhaustive, and it is still growing. Computers and telephones, for example, have been around for decades. Others, such as cell phones, digital televisions, and robotics, are newer entrants. ICT commonly means more than its list of components, though. It also encompasses the application of all those various components. It's here that the real potential, power and danger of ICT can be found. An overview of the components of ICT is listed below:

1. **Software:** According to Rosencrance (2021) Software is a set of instructions, data or programs used to operate computers and execute specific tasks. It is the opposite of hardware, which describes the physical aspects of a computer. Software is a generic term used to refer to applications, scripts and programs that run on a device. It can be thought of as the variable part of a computer, while hardware is the invariable part. The two main categories of software are application software and system software. An application is software that fulfils a specific need or performs tasks. System software is designed to run a computer's hardware and provides a platform for applications to run on top of. Other types of software include programming software, which provides the programming tools software developers need; middleware, which sits between system software and applications; and driver software, which operates computer devices and peripherals. Early software was written for specific computers and sold with the hardware it ran on. In the 1980s, software began to be sold on floppy disks, and later on CDs and DVDs. Today, most software is purchased and directly downloaded over the internet. Software can be found on vendor websites or application service provider websites. A computer software is divided into two broad categories i.e. System Software and Application software.

2. **Hardware:** According to Awati (2021) Computer hardware is a

collective term used to describe any of the physical components of an analog or digital computer. The term hardware distinguishes the tangible aspects of a computing device from software, which consists of written, machine-readable instructions or programs that tell physical components what to do and when to execute the instructions. Hardware and software are complementary. A computing device can function efficiently and produce useful output only when both hardware and software work together appropriately. Computer hardware can be categorized as being either internal or external components. Generally, internal hardware components are those necessary for the proper functioning of the computer, while external hardware components are attached to the computer to add or enhance functionality.

3. **Cloud Computing:** Chai (2022) highlight that Cloud computing is a catch-all word for anything involving the delivery of hosted services through the internet. These services are classified into three types: infrastructure as a service (IaaS), platform as a service (PaaS), and software as a service (SaaS). A cloud can be both private and public. A public cloud sells services to anyone with access to the internet. A private cloud is a proprietary network or data centre that provides hosted services to a small group of people with restricted access and rights. The hardware and software components required for the correct deployment of a cloud computing architecture are referred to as cloud infrastructure. Cloud computing is also known as utility computing and on- demand computing. The term cloud computing was inspired by the cloud symbol, which is frequently used in flowcharts and diagrams to symbolise the internet.

4. **Data storage and management:** Data storage and management refer to the methods, processes, and technologies involved in storing, organizing, securing, and retrieving data. Effective data storage and management systems are essential for businesses, organizations, and

individuals to efficiently handle and utilize their data. Effective data storage and management practices are essential for ensuring data integrity, availability, and security. They enable organizations to make informed decisions, improve operational efficiency, comply with regulations, and unlock valuable insights from their data assets. Crocetti (2021) states that Resource provisioning, process automation, load balancing, capacity planning and management, predictive analytics, performance monitoring, replication, compression, deduplication, snapshotting, and cloning are all important elements for overall data storage management providers. Recent vendor trends include cloud storage services and the container management platform Kubernetes. Top storage services can handle a variety of platforms. And, despite being more specialised, Kubernetes has gaining traction: Kubernetes services are provided by vendors such as Diamanti, NetApp, and Pure Storage. For storage companies, some type of cloud management is practically required. Cloud data management is a feature of a few vendors' platforms, including Cohesity and Rubrik. Because many businesses use more than one cloud, multi-cloud data management is critical.

5. Network: Networking, often known as computer networking, is the practice of transmitting and sharing data between nodes in an information system via a shared channel. Networking is the design, development, and use of a network, as well as the management, maintenance, and operation of the network infrastructure, software, and policies. Computer networking connects devices and endpoints on a local area network (LAN) or a larger network, such as the Internet or a private wide area network (WAN). Everything from phone conversations to text messaging to streaming video to the Internet of Things (IoT) is made easier by networking. The level of skill required to operate a network is directly proportional to its complexity (Scarpati,

2018). Yasar and Gillis (2023) highlighted that to communicate with one another over the internet and on other computer networks, devices connected to a computer network utilize IP addresses that are resolved into hostnames by a domain name system server. A number of protocols and techniques are also used to specify data transport between endpoints. To function, network systems must adhere to particular standards or norms. Standards are a set of data transmission rules that must be followed in order for information to be exchanged between devices. They are established by several standards organizations such as IEEE, the International Organisation for Standardisation, and the American National Standards Institute. The Ethernet standard, for example, defines a common communication language for wired or physical networks, whereas the 802.11 standard defines connectivity for wireless local area networks (WLANs).

1.4 Scope of Information and Communication Technology

The scope of ICT is vast and continually expanding, shaping our digital society in remarkable ways. The rise of the internet has had a profound impact on society, transforming the way we communicate, access information, conduct business, and interact with the world. Its influence spans education, communication, business, healthcare, governance, entertainment, and various other sectors. ICT empowers individuals, businesses, and governments with enhanced efficiency, productivity, and connectivity. As technology continues to evolve, the scope of ICT will only continue to grow, presenting new possibilities and opportunities for innovation, collaboration, and societal development. Embracing ICT is vital for individuals and societies to thrive in the digital age and realize the full potential of a connected world.

1. **Education:** Students and teachers have rapid access to a great amount of knowledge and instructional tools because to ICT. The internet is a vast library of knowledge that allows students to conduct research, explore other points of view, and access up-to-date information. Online

libraries, digital textbooks, and educational websites provide a multitude of materials that help students learn more effectively. It also makes interactive and interesting learning sessions possible. Videos, animations, and interactive simulations are examples of multimedia features that make complex subjects more accessible and entertaining. Interactive exercises, quizzes, and games provided by online learning platforms and educational software encourage active engagement and reinforce learning. ICT also offers personalised learning experiences that are adapted to the requirements and tastes of individual students. Data analytics are used by adaptive learning systems to measure student performance and give personalised learning courses. Personalised content, adaptive exams and feedback are available through online platforms and educational apps, allowing students to learn at their own speed and style. ICT encourages students and instructors to be inventive and creative in their learning and communication. Discussion forums and social media platforms encourage engagement, knowledge sharing, and group initiatives. Remote learning is enabled through virtual classrooms and video conferencing platforms, which connect students and teachers across geographic barriers, enabling global collaboration and cultural exchange. ICT promotes teacher professional development by allowing educators to improve their teaching skills, stay up to speed on the latest pedagogical ideas, and collaborate with peers all over the world. Online training classes, webinars, and educational platforms all provide resources and tools for professional development. Administrative activities in educational institutions have been simplified, enhancing efficiency and minimising paperwork. Student record, attendance, grading, and schedule management systems streamline administrative processes. Online platforms for course registration, fee payments, and parent communication save administrative workload. It makes digital evaluation methods more accessible, lowering the need for traditional

pen-and-paper exams. Online quizzes, assignments, and automatic grading systems help to speed up the evaluation process. Students can use digital portfolios and e-portfolios to present their work and obtain feedback from lecturers and peers. ICT promotes lifelong learning by giving adults access to educational resources and courses that help them improve their skills and knowledge. Individuals can engage in ongoing learning and professional improvement throughout their lives thanks to online platforms, webinars, and digital libraries.

2. **Communication and Social Interaction:** The Information and Communication Technology (ICT) era has usher in a new paradigm of communication and interaction, fundamentally altering how we connect, cooperate, and engage with people. Rapid technological improvements have not only made communication faster and more efficient, but they have also enabled unprecedented levels of global connectivity. The advent of social media, instant and worldwide connectivity, different modalities of communication, and the rise of instant and global connectivity have revolutionised the way we interact, collaborate, and engage with others. While there are certain drawbacks, such as the possibility of miscommunication and privacy concerns, the advantages of ICT in communication much exceed the disadvantages. It is critical to seize ICT's opportunities while navigating the digital terrain with mindfulness and awareness, ensuring that communication and interaction remain relevant, inclusive, and secure in this interconnected world. Geographical barriers have been knocked down by ICT, allowing people to interact quickly across great distances. Real-time communication is enabled via platforms such as email, instant messaging, and video conferencing, which enhance collaboration and bridge cultural boundaries. People may connect with friends, family, and colleagues all over the world with only a few clicks, creating a sense of a close-knit global community. ICT tools and

platforms have transformed professional communication, resulting in enhanced efficiency and productivity. Email, project management software, and collaboration tools let teams communicate more effectively, guaranteeing a seamless flow of information and effective coordination. Teleconferencing and virtual meetings have decreased the need for travel, saving time and money while boosting effective communication. We now have access to audio and video communication channels in addition to traditional text-based communication channels. Richer and more immersive communication experiences are provided by voice and video calls, live streaming, and video sharing platforms. Nonverbal cues and facial emotions can be detected and exchanged in real time, improving conversation quality and depth. In the ICT era, social media platforms have grown pervasive, revolutionising the way we connect and interact with people. Individuals can use these platforms to share their experiences, thoughts, and opinions, forming virtual communities and building social connections. Online forums, interest groups, and virtual communities have evolved into gathering places for like-minded people to exchange knowledge and engage in meaningful discussions.

3. **Business and Economy:** The impact of Information and Communication Technology (ICT) on business and the economy has been tremendous and far- reaching. Advances in information and communication technology (ICT) have transformed the way organisations operate, communicate, and connect with customers, resulting in enhanced efficiency, productivity, and innovation. ICT has enabled seamless connectivity and enhanced enterprises' global reach. Companies can develop a presence beyond their physical sites by using the internet and digital platforms to reach clients and markets worldwide. E- commerce platforms allow firms to offer items and services to a large number of customers online. This worldwide reach

has created new growth prospects, boosted market rivalry, and accelerated economic development. Tools and systems based on ICT have improved company processes, increasing efficiency and production. Through enterprise resource planning (ERP) systems, task automation, data processing, and inventory management have reduced manual labour and human error. Real-time information sharing is enabled via communication and collaboration platforms, increasing productivity and decision-making. Cloud computing enables businesses to use computing resources as needed, lowering infrastructure costs and increasing scalability. ICT has also changed marketing methods, allowing for more focused and personalised approaches. Digital marketing channels such as social media, search engine optimisation (SEO), and email marketing enable organisations to contact their target customers at a low cost. Businesses can use data analytics and customer relationship management (CRM) systems to acquire insights into consumer behaviour, preferences, and needs, allowing for personalised marketing and enhanced customer engagement.

The rise of e-commerce and online retail platforms has revolutionised the retail industry as ICT has advanced. Consumers may now shop from anywhere, at any time, and gain access to a diverse choice of products and services. Online marketplaces such as Amazon and Alibaba have challenged traditional retail patterns by providing a varied range of products at competitive prices. ICT has also enabled secure online transactions, resulting in the expansion of digital payment systems and a decrease in reliance on cash-based transactions. Cloud-based project management tools, video conferencing, and file-sharing platforms enable geographically distributed teams to collaborate and communicate in real time. Businesses can benefit from cost savings and specialised skills by outsourcing various tasks to global partners. Supply chain globalisation has revolutionised business operations and driven

economic growth. The rise of remote work and digital nomadism has been facilitated by ICT, altering the traditional office-based work culture. Professionals can work from anywhere now that high-speed internet and collaboration technologies are available, decreasing the need for real office facilities. This transition has given people more flexibility, boosted career opportunities, and allowed corporations to tap into a worldwide talent pool.

4. **Healthcare:** The ability to deliver remote healthcare services is one of the most significant innovations brought about by ICT. Telemedicine allows patients to consult with healthcare specialists at a distance, reducing geographical barriers and boosting access to care, particularly for those living in rural or underserved areas. Patients can receive medical advice, prescriptions, and monitor their health issues from the comfort of their own homes via video conferencing, remote monitoring, and mobile health applications. Paper-based medical records have given way to electronic health records (EHRs) in the digital age. Healthcare practitioners can use EHRs to securely store, access, and share patient information digitally. This improves care coordination, cuts down on errors, and increases patient safety. EHRs also make it easier for different healthcare practitioners to exchange medical data, increasing continuity of treatment and improving overall healthcare results. With the emergence of wearable technology such as fitness trackers, smartwatches, and medical sensors, people may now continuously monitor their health and wellness. These gadgets are capable of monitoring vital signs, activity levels, sleep patterns, and other health-related information. Remote monitoring systems enable healthcare providers to remotely monitor patients with chronic diseases, allowing for early intervention, personalised treatment programmes, and lower hospital readmissions. Individuals can now take control of their health and wellness thanks to the rise of health-related smartphone

applications. Symptom tracking, medication reminders, fitness programmes, and mental health support are all available through health apps. These instruments encourage self-care, patient participation, and health education. Furthermore, digital health platforms provide consumers with access to a variety of health information, allowing them to make informed decisions about their health. With the introduction of AI and data analytics, healthcare has been altered by harnessing massive datasets to better diagnosis, treatment planning, and patient outcomes. AI systems can analyse medical pictures like X-rays and MRIs to help spot diseases. Machine learning algorithms can recognise trends and anticipate patient outcomes, allowing for more personalised therapy suggestions.

Data analytics also allows for population health management, the identification of health patterns, and the direction of public health actions. Precision medicine has benefited greatly from advances in information and communication technology. Precision medicine develops personalised treatment approaches by taking into consideration an individual's unique genetic makeup, lifestyle, and environmental circumstances. ICT enables the storage, analysis, and interpretation of large-scale genomic data, allowing particular biomarkers to be identified, patients to be matched with focused medicines, and treatment efficacy to be improved. ICT has made it easier for diverse healthcare providers and systems to share health information. Interoperability standards and Health Information Exchanges (HIEs) enable the secure exchange of patient data between organisations, ensuring smooth care transitions and increasing care coordination. This information sharing allows healthcare practitioners to have a thorough understanding of their patients' medical histories, resulting in more informed decisions and better patient outcomes. ICT has given people the ability to actively participate in their own healthcare. Medical records, appointment scheduling, and secure

interaction with healthcare practitioners are all available through online portals and patient engagement platforms. Patients can look for health information, access educational materials, and join online support groups. This increased patient engagement encourages shared decision-making, enhances communication, and increases patient satisfaction.

5. **Governance:** ICT has enabled the development and implementation of e- government services, providing citizens with online access to government information, services, and transactions. Through government portals and digital platforms, individuals can access services such as tax filing, license applications, and permit renewals conveniently and efficiently. E-government services streamline bureaucratic processes, reduce paperwork, and enhance service delivery to citizens. Open data initiatives make government data available to the public in a machine-readable format, enabling citizens, researchers, and businesses to analyse and utilize the data for various purposes. Online portals provide access to government documents, budgets, and policies, allowing citizens to monitor government activities and hold officials accountable. ICT has transformed citizen engagement and participation in public governance. Online platforms, social media, and e-participation tools enable citizens to provide feedback, express opinions, and participate in policy- making processes. Virtual town halls, online surveys, and crowdsourcing platforms allow governments to gather public input and incorporate citizen perspectives into decision-making. This enhances democratic processes, increases trust, and promotes inclusive governance. Digital platforms enable online voting, e-petitions, and e-democracy initiatives, enabling citizens to express their preferences and participate in decision-making beyond traditional voting methods. Digital democracy initiatives foster greater citizen involvement, bridge the gap between government and citizens, and enable more responsive governance. Data analytics and

performance management systems help governments track key performance indicators, measure outcomes, and identify areas for improvement. This data-driven approach allows for evidence-based policy-making, efficient resource allocation, and effective monitoring of government programs and initiatives.

ICT has contributed to the development of smart cities and transformed urban governance. Smart city technologies, such as internet devices, sensors, and data analytics, enable governments to monitor and manage city infrastructure, transportation systems, and public services efficiently. Smart city initiatives enhance citizen safety, improve resource management, and promote sustainable development. ICT facilitates real-time data collection, analysis, and decision-making, leading to more effective urban governance. Digital platforms and automation tools streamline internal government operations, reducing paperwork, manual processes, and administrative costs. ICT solutions, such as enterprise resource planning (ERP) systems, enable integration and sharing of data across government departments, enhancing coordination and communication. This improves the overall efficiency and effectiveness of public governance. ICT has also presented challenges related to cybersecurity and data privacy in public governance. Governments must ensure the security of sensitive data, protect against cyber threats, and safeguard citizens' privacy. Robust cybersecurity measures, data protection regulations, and policies are essential to maintain public trust and protect confidential information in the digital age.

6. Entertainment: Entertainment in the digital era has undergone a remarkable transformation, reshaping the way we consume, access, and engage with various forms of entertainment. The rapid advancement of Information and Communication Technology (ICT) has revolutionized the entertainment industry, offering a wide range of digital platforms,

immersive experiences, and interactive content. The rise of digital streaming services, such as Netflix, Amazon Prime Video, and Disney+, has disrupted the traditional model of consuming entertainment. These platforms offer on-demand access to a vast library of movies, TV shows, and original content. Users can stream their favourite content anytime, anywhere, on multiple devices, providing flexibility and convenience. Digital streaming services have fundamentally changed how we access and consume entertainment, giving users control over what, when, and how they watch.

Online gaming has become a major part of entertainment in the digital era. The growth of high-speed internet and powerful gaming consoles and PCs has facilitated multiplayer online gaming experiences. Gamers can connect with players worldwide, compete, collaborate, and engage in immersive virtual worlds. The advent of e-sports has turned gaming into a professional and highly competitive industry, with tournaments, live streaming, and a dedicated fan base. Social media platforms have transformed entertainment by enabling users to create, share, and engage with user-generated content. Platforms like YouTube, TikTok, and Instagram have given rise to a new generation of content creators, influencers, and digital celebrities. Users can create and share videos, music, and other forms of creative content, gaining followers and building communities around their interests. Social media has democratized entertainment, allowing anyone with talent and creativity to gain visibility and reach a global audience.

Virtual Reality (VR) and Augmented Reality (AR) technologies have revolutionized entertainment experiences, immersing users in virtual environments or overlaying digital elements onto the real world. VR enables users to explore virtual worlds, play games, and experience interactive storytelling. AR enhances real-world experiences by overlaying digital content, such as information, graphics, or characters,

onto the user's view. These technologies offer unique and immersive entertainment experiences, from gaming to virtual tours, training simulations, and live events. The digital era has introduced personalized entertainment experiences through recommendation algorithms. Streaming platforms and digital services analyse user preferences, viewing habits, and behaviour to suggest content tailored to individual tastes. This personalization enhances user engagement and discovery of new content, creating a more immersive and enjoyable entertainment experience.

Live streaming platforms, such as Twitch and YouTube Live, have gained popularity, allowing users to broadcast and interact with audiences in real-time. Live streaming enables gamers, musicians, content creators, and influencers to engage with their fans, share experiences, and monetize their content. Additionally, social media platforms provide features for live video streaming, enabling users to share live events, performances, and behind-the- scenes moments. The digital era has transformed the music industry with the advent of digital music platforms, such as Spotify, Apple Music, and Sound Cloud. Users can access a vast catalogue of music, create playlists, discover new artists, and enjoy personalized recommendations. Podcasting has also gained momentum, offering a platform for individuals and organizations to create and share audio content on a wide range of topics. Digital music and podcasts have made entertainment more accessible, diverse, and customizable.

1.5 Genesis of Information and Communication Technology (ICT)

The field of Information and Communication Technology (ICT) has transformed the way we live, work, and communicate in unprecedented ways. This essay explores the historical perspective of ICT, tracing its roots back to the early developments of computing and communication technologies.

Spanning several decades, this comprehensive analysis highlights key milestones and breakthroughs that have shaped the modern world. From the invention of the telegraph to the rise of the Internet and beyond, this essay examines the societal, economic, and technological implications of ICT's evolution. By understanding the historical context of ICT, we gain valuable insights into its present state and potential future.

1.5.1 Early Origins of Computing

The technology of computing is now a sudden development that came out of the blue but a continuing process that occurs through the course of time. The early origins of computing can be traced back to several key developments and innovations over the centuries. Here are some significant milestones in the history of computing:

1. **Abacus (3000 BCE):** The abacus, one of the earliest known calculating devices, originated in ancient Mesopotamia and China. It consisted of a series of beads or stones on rods and allowed for basic arithmetic calculations.
2. **Mechanical Calculators (17th century):** Inventors like Blaise Pascal and Gottfried Wilhelm Leibniz developed mechanical calculators in the 17th century. These machines used gears, levers, and rotating wheels to perform calculations.
3. **Analytical Engine (1837):** Designed by Charles Babbage, the Analytical Engine is considered the precursor to modern computers. Although it was never fully constructed during Babbage's lifetime, the machine featured key elements of a modern computer, including a central processing unit (CPU) and the ability to store and retrieve data.
4. **Tabulating Machines (late 19th century):** In the late 1800s, Herman Hollerith invented tabulating machines, which used punched cards to store and process data. These machines were used for tasks such as census tabulation and formed the foundation for early data processing.

5. **Vacuum Tubes (1904):** The invention of vacuum tubes by John Ambrose Fleming and their later improvement by Lee De Forest in the early 20th century led to the development of electronic devices that could amplify and switch electrical signals. Vacuum tubes were used in early electronic computers for tasks like calculations and data storage.

6. **Turing Machine (1936):** Proposed by Alan Turing, the Turing Machine was a theoretical device that laid the foundation for the concept of a general-purpose computer. It demonstrated the idea of a machine that could execute instructions based on a set of rules or algorithms.

7. **ENIAC (1946):** The Electronic Numerical Integrator and Computer (ENIAC) was the first general-purpose electronic digital computer. It used vacuum tubes and performed calculations for tasks such as artillery trajectory calculations during World War II.

8. **Transistors (1947):** The invention of the transistor by John Bardeen, Walter Brattain, and William Shockley revolutionized computing. Transistors replaced vacuum tubes, providing smaller, faster, and more reliable electronic components for computers.

9. **Integrated Circuits (1960s):** The development of integrated circuits, which combined multiple transistors and other electronic components on a single chip of silicon, further miniaturized computers and increased their processing power.

10. **Personal Computers (1970s):** Companies like Apple and IBM introduced personal computers in the 1970s, making computing accessible to individuals. These machines featured user-friendly interfaces and became the foundation for the widespread adoption of computers in homes and offices.

These early developments set the stage for the rapid advancement of

computing technology over the following decades, leading to the powerful and interconnected systems we rely on today.

1.5.2 Charles Babbage and the Concept of the Analytical Engine

Charles Babbage was a British mathematician and inventor who is widely credited with developing the Analytical Engine, a forerunner of contemporary computers. In the early nineteenth century, Babbage devised and suggested the Analytical Engine.

The Analytical Engine was a sophisticated mechanical device that combined the functions of a calculator and a programmable machine. Babbage envisioned it as a general-purpose computer capable of executing a wide range of sophisticated calculations and activities. Swaine (2023) remarked that "The Analytical Engine was to be a general-purpose, fully program-controlled, automatic mechanical digital computer. It would be able to perform any calculation set before it. There is no evidence that anyone before Babbage had ever conceived of such a device, let alone attempted to build one. The machine was designed to consist of four components: the mill, the store, the reader, and the printer. These components are the essential components of every computer today. The mill was the calculating unit, analogous to the central processing unit (CPU) in a modern computer; the store was where data were held prior to processing, exactly analogous to memory and storage in today's computers; and the reader and printer were the input and output devices. As with the Difference Engine, the project was far more complex than anything theretofore built. The store was to be large enough to hold 1,000 50-digit numbers; this was larger than the storage capacity of any computer built before 1960. The machine was to be steam- driven and run by one attendant. The printing capability was also ambitious, as it had been for the Difference Engine: Babbage wanted to automate the process as much as possible, right up to producing printed tables of numbers. The reader was another new feature of the Analytical Engine. Data (numbers) were to be entered on punched cards, using

the card-reading technology of the Jacquard loom. Instructions were also to be entered on cards, another idea taken directly from Joseph-Marie Jacquard. The use of instruction cards would make it a programmable device and far more flexible than any machine then in existence. (In 1843 mathematician Ada Lovelace wrote in her notes for a translation of a French article about the Analytical Engine how the machine could be used to follow a program to calculate Bernoulli numbers. For this, she has been called the first computer programmer.) Another element of programmability was to be its ability to execute instructions in other than sequential order. It was to have a kind of decision-making ability in its conditional control transfer, also known as conditional branching, whereby it would be able to jump to a different instruction depending on the value of some data. This extremely powerful feature was missing in many of the early computers of the 20th century." Features of analytical engine are:

1. **Store and Memory:** The machine would have a memory storage system known as the "store," which could hold both instructions and data. It used punch cards for input and output, allowing for the storage and manipulation of information.

2. **Arithmetic Unit:** The Analytical Engine included a separate arithmetic unit, known as the "mill," which could perform arithmetic calculations like addition, subtraction, multiplication, and division. It also had capabilities for more advanced operations such as logarithmic and trigonometric functions.

3. **Control Flow:** The machine had a control unit called the "mill control," which could execute instructions based on a program. This concept of program control made the Analytical Engine programmable and capable of performing different tasks based on the given instructions.

4. **Loops and Conditional Branching:** Babbage's design incorporated loops and conditional branching, enabling the repetition of instructions

or the execution of different instructions based on certain conditions. This introduced the concept of conditional control flow, which is crucial in modern programming.

1.5.3 Generation of Computer

Computer generations refer to the various stages or phases of development in computer technology. Each generation is characterized by significant advancements in hardware, software, and computing capabilities. Here is a brief overview of the different computer generations:

1. **First Generation (1940s-1950s):** The first electronic computers were developed during this period. They were large, vacuum tube-based machines that consumed a lot of power and generated a significant amount of heat. Examples include the ENIAC and UNIVAC computers.

2. **Second Generation (1950s-1960s):** The second generation introduced the use of transistors instead of vacuum tubes, which made computers smaller, more reliable, and more efficient. Magnetic cores were also used for primary memory. IBM 1401 and IBM 7090 are examples of computers from this era.

3. **Third Generation (1960s-1970s):** The third generation saw the development of integrated circuits (ICs), which allowed multiple transistors and electronic components to be miniaturized and placed on a single silicon chip. This led to a significant increase in computing power, reduction in size, and decrease in cost.

4. **Fourth Generation (1970s-1980s):** Microprocessors, which contained the entire CPU on a single chip, were introduced during the fourth generation. This innovation revolutionized the computer industry, enabling personal computers (PCs) to be developed. Notable computers of this era include the IBM PC, Apple II, and Commodore 64.

5. **Fifth Generation (1980s-Present):** The fifth generation is characterized by the development of very large-scale integration (VLSI) technology, which allowed for the creation of highly complex microchips with millions of transistors. This led to further miniaturization, increased processing power, and the emergence of personal computers, laptops, and mobile devices. The period also saw advancements in networking and the birth of the internet.

6. **Sixth Generation (Present and Beyond):** While the concept of the sixth generation is not yet clearly defined, it is often associated with emerging technologies such as artificial intelligence, quantum computing, and advanced robotics. These technologies are expected to push the boundaries of computing even further and revolutionize various industries.

1.6 Introduction of Information Technology in the Fields of Communication

Communication has evolved over thousands of years, from primitive forms of nonverbal communication to sophisticated modern modes of information transmission. Humans relied on nonverbal modes of communication such as gestures, facial expressions, and body language before the creation of writing systems. Early human civilizations are said to have utilized cave paintings and rock art to communicate messages and share information. The invention of writing systems was a great step forward in communication. Early writing systems, such as Mesopotamian cuneiform and Egyptian hieroglyphics, enabled information to be stored and transferred across time and distance. Words, concepts, and sounds were represented by graphical symbols or characters in these systems. Postal systems were built by ancient civilizations such as the Egyptians, Persians, and Romans to carry written letters. Couriers, riders, or messengers were used in these systems to convey written papers or letters over large distances, facilitating communication between distant places. The printing press, invented by

Johannes Gutenberg in the mid-15th century, revolutionized communication by enabling the mass production of books and other written materials which resulted in widespread knowledge distribution, higher literacy, and expanded idea sharing.

1.6.1 Invention of Morse's Code

Morse code refers to one of two techniques for representing letters of the alphabet, numerals, and punctuation marks with a series of dots, dashes, and spaces. The codes are communicated as variable-length electrical pulses or comparable mechanical or visual signals, such as flashing lights. The original "American" Morse code and the later International Morse Code, which became the global standard, are the two systems. Except for minor revisions in 1938, the International Morse Code has remained unchanged since its beginnings. (Because the American telegraph business never abandoned the original Morse code, it was used until the advent of tele-printers in the 1920s and 1930s.) International Morse Code was utilized during WWII, as well as the Korean and Vietnam Wars. It was heavily employed by the shipping industry and for maritime safety until the early 1990s. Although amateur radio only made up a minor portion of Morse code usage, it did qualify hundreds of operators for military communications duties. Most countries had omitted the ability to decode Morse code from the qualifications for acquiring an amateur radio license by the early 2000s.

Samuel Morse was an American painter and inventor, while Alfred Vail was his assistant and collaborator. The development of Morse code was closely tied to the invention of the electric telegraph, which was a device that allowed messages to be transmitted over long distances using electrical signals. Morse and Vail worked together to improve upon earlier telegraph designs and create a more practical and efficient system. Morse code is a method of representing letters, numbers, and punctuation marks using a combination of dots and dashes. Each letter and symbol in the English alphabet is assigned a

unique sequence of short and long signals, with shorter signals representing dots and longer signals representing dashes. The basic principles of Morse code were first publicly demonstrated in 1837, and the code was further refined and standardized over the following years. In 1844, Morse successfully sent the famous message "What hath God wrought" over a telegraph line from Washington, D.C. to Baltimore, Maryland, marking a significant milestone in the history of communication. Morse code quickly gained popularity and became the standard method of communication for telegraph operators around the world. It was widely used for long-distance communication, particularly in maritime and military contexts, where it played a crucial role in ensuring efficient and reliable communication. Despite advancements in technology and the development of more sophisticated communication systems, Morse code continued to be used well into the 20th century. It remained an essential skill for radio operators, and its simplicity and resilience made it valuable in situations where other methods of communication were unavailable or unreliable. While the Morse code is not as widely used today as it once was, it still holds historical and cultural significance. It remains an important part of the history of telecommunications and is recognized as one of the earliest forms of digital communication.

1.6.2 Invention of Telegram

The term telegraph derives from the Greek terms tele, which means "distant," and graphene, which means "to write." It was first used to describe an optical semaphore system established in France near the end of the 18th century. Many methods of telegraphic communication, however, have been used since before

recorded history. The oldest methods of long-distance communication made use of media such as smoke, fire, drums, and reflected Sun rays. Visual signals such as flags and torches were employed for short-distance communication far into the twentieth century, when the two-flag semaphore system was widely used, particularly by the world's warships. Prior to the invention of the electric telegraph, visual systems were utilized to send messages across long distances using variable displays. The semaphore, invented in 1791 in France by the Chappe brothers, Claude and Ignace, was one of the most successful visual telegraphs. This system consists of movable arms positioned on hilltop towers at the extremities of crossbeams. The horizontal beam could tilt 45° clockwise or anticlockwise, and each arm of the semaphore could assume seven angular positions 45° apart. It was feasible to express numbers and letters of the alphabet in this way. To allow transmission across vast distances, chains of these towers were created. George Murray in England invented another widely used visual telegraph in 1795. Characters were sent using Murray's invention by opening and shutting various combinations of six shutters. This technique quickly caught on in England and the United States, where a number of Telegraph Hill or Signal Hill sites can still be found, particularly in coastal areas. By the middle of the nineteenth century, the electric telegraph had totally superseded the visual telegraph. (McGillem, 2023)

1.6.3 Invention of Telephone

During the 19th century inventors such as Charles Bourseul, Antonio Meucci, Johann Phillip Reis, etc. made several attempts to transmit sound over electronic device but the ground breaking invention was delivered by Alexander Graham Bell. Alexander Graham Bell was deeply interested in the transmission of sound and speech. His interest was influenced by his father, Alexander Melville Bell, who was a renowned phonetician and speech teacher. Bell also drew inspiration from the work of Hermann von Helmholtz, a German scientist who studied the physics of sound. Bell and his assistant, Thomas Watson, were experimenting with the idea of transmitting multiple telegraph

messages simultaneously over a single telegraph wire. During their experiments, they discovered that the vibrations produced by a tuning fork could be used to transmit sound. While working on the development of the harmonic telegraph, Bell accidentally spilled battery acid, causing a breakthrough. The acid-induced vibrations produced a distinct sound pattern that Bell recognized as analogous to human speech. This discovery led to the successful transmission of sound and the ability to transmit voice signals electrically.

On March 10, 1876, Bell made the first successful telephone call to his assistant, Thomas Watson, who was in a separate room. Bell spoke the now-famous phrase, "Mr. Watson, come here. I want to see you." Watson, hearing Bell's voice transmitted through the telephone, understood the significance of the moment.

David E. Borth in his Article, 'Telephone' illustrate the working component of a telephone as:

1. **Power Source:** In the first experimental telephones the electric current that powered the telephone circuit was generated at the transmitter, by means of an electromagnet activated by the speaker's voice. Such a system could not generate enough voltage to produce audible speech in distant receivers, so every transmitter since Bell's patented design has operated on a direct current supplied by an independent power source. The first sources were batteries located in the telephone instruments themselves, but since the 1890s current has been generated at the local switching office. The current is supplied through a two-wire circuit called the local loop. The standard voltage is 48 volts. Cordless telephones represent a return to individual power sources in that their low-wattage radio transmitters are powered by a small (e.g., 3.6-volt) battery located in the portable handset. When the telephone is not in use, the battery is recharged through contacts with the base unit. The

base unit is powered by a transformer connection to a standard electric outlet.

2. **Switch Hook:** The switch hook connects the telephone instrument to the direct current supplied through the local loop. In early telephones the receiver was hung on a hook that operated the switch by opening and closing a metal contact. This system is still common, though the hook has been replaced by a cradle to hold the combined handset, enclosing both receiver and transmitter. In some modern electronic instruments, the mechanical operation of metal contacts has been replaced by a system of transistor relays. When the telephone is "on hook," contact with the local loop is broken. When it is "off hook" (i.e., when the handset is lifted from the cradle), contact is restored, and current flows through the loop. The switching office signals restoration of contact by transmitting a low-frequency "dial tone"—actually two simultaneous tones of 350 and 440 hertz.

3. **Dialler:** The dialler is used to enter the number of the party that the user wishes to call. Signals generated by the dialler activate switches in the local office, which establish a transmission path to the called party. Diallers are of the rotary and push-button types. The traditional rotary dialler, invented in the 1890s, is rotated against the tension of a spring and then released, whereupon it returns to its position at a rate controlled by a mechanical governor. The return rotation causes a switch to open and close, producing interruptions, or pulses, in the flow of direct current to the switching office. Each pulse lasts approximately one-tenth of a second; the number of pulses signals the number being dialled. In push-button dialling, introduced in the 1960s, the pressing of each button generates a "dual-tone" signal that is specific to the number being entered. Each dual tone is composed of a low frequency (697, 770, 852, or 941 hertz) and a high frequency (1,209, 1,336, or 1,477 hertz), which are sensed and decoded at the switching office.

Unlike the low-frequency rotary pulses, dual tones can travel through the telephone system, so that push-button telephones can be used to activate automated functions at the other end of the line. In both rotary and push-button systems, a capacitor and resistor prevent dialling signals from passing into the ringer circuit.

4. **Ringer:** The ringer alerts the user to an incoming call by emitting an audible tone or ring. Ringers are of two types, mechanical or electronic. Both types are activated by a 20-hertz, 75-volt alternating current generated by the switching office. The ringer is commonly activated in two-second pulses, with each pulse separated by a pause of four seconds. The traditional mechanical ringer was introduced with the early Bell telephones. It consists of two closely spaced bells, a metal clapper, and a magnet. Passage of alternating current through a coil of wire produces alternations in the magnetic attraction exerted on the clapper, so that it vibrates rapidly and loudly against the bells. Volume can be muted by a switch that places a mechanical damper against the bells. In modern electronic ringers, introduced in the 1980s, the ringer current is passed through an oscillator, which adjusts the current to the precise frequency required to activate a piezoelectric transducer—a device made of a crystalline material that vibrates in response to an electric current. The transducer may be coupled to a small loudspeaker, which can be adjusted for volume. The ringer circuit remains connected to the local loop even when the telephone is on hook. A larger voltage is necessary to activate the ringer because the ringer circuit is made with a high electrical impedance in order to avoid draining power from the transmitter-receiver circuit when the telephone is in use. A capacitor prevents direct current from passing through the ringer once the handset has been lifted off the switch hook.

5. **Transmitter:** The transmitter is essentially a tiny microphone located in the mouthpiece of the telephone's handset. It converts the vibrations

of the speaker's voice into variations in the direct current flowing through the set from the power source. In traditional carbon transmitters, developed in the 1880s, a thin layer of carbon granules separates a fixed electrode from a diaphragm-activated electrode. Electric current flows through the carbon against a certain resistance. The diaphragm, vibrating in response to the speaker's voice, forces the movable electrode to exert a fluctuating pressure on the carbon layer. Fluctuations in the carbon layer create fluctuations in its electrical resistance, which in turn produce fluctuations in the electric current. In modern electret transmitters, developed in the 1970s, the carbon layer is replaced by a thin plastic sheet that has been given a conductive metallic coating on one side. The plastic separates that coating from another metal electrode and maintains an electric field between them. Vibrations caused by speech produce fluctuations in the electric field, which in turn produce small variations in voltage. The voltages are amplified for transmission over the telephone line.

6. **Receiver:** The receiver is located in the earpiece of the telephone's handset. Operating on electromagnetic principles that were known in Bell's day, it converts fluctuating electric current into sound waves that reproduce human speech. Fundamentally, it consists of two parts: a permanent magnet, having pole pieces wound with coils of insulated fine wire, and a diaphragm driven by magnetic material that is supported near the pole pieces. Speech currents passing through the coils vary the attraction of the permanent magnet for the diaphragm, causing it to vibrate and produce sound waves. Through the years the design of the electromagnetic system has been continuously improved. In the most common type of receiver, introduced in the Bell system in 1951, the diaphragm, consisting of a central cone attached to a ring-shaped armature, is driven as a piston to obtain efficient response over a wide frequency range. Telephone receivers are designed to have an

accurate response to tones with frequencies of 350 to 3,500 hertz—a dynamic range that is narrower than the capabilities of the human ear but sufficient to reproduce normal speech.

7. **Anti-side tone circuit:** The anti-side tone circuit is an assemblage of transformers, resistors, and capacitors that perform a number of functions. The primary function is to reduce side tone, which is the distracting sound of the speaker's own voice coming through the receiver from the transmitter. The anti-side tone circuit accomplishes this reduction by interposing a transformer between the transmitter circuit and the receiver circuit and by splitting the transmitter signals along two paths. When the divided signals, having opposite polarities, meet at the transformer, they almost entirely cancel each other in crossing to the receiver circuit. The speech signal coming from the other end of the line, on the other hand, arrives at the transformer along a single, undivided path and crosses the transformer unimpeded. The anti-side tone circuit also matches the low electrical impedance of the telephone instrument's circuits to the higher electrical impedance of the telephone line. Impedance matching allows a more efficient flow of current through the system. (Borth, 2023)

1.7 Information and Communication Technology (ICT) Skills and Competencies

In today's increasingly digital world, information and communication technologies (ICT) have become integral to our personal and professional lives. ICT skills and competencies are essential for individuals to effectively navigate, use, and leverage these technologies.

ICT skills encompass a wide range of abilities that enable individuals to interact with digital technologies. They include basic computer skills, such as operating hardware and software, managing files, and understanding computer terminology. Digital literacy is another critical aspect of ICT skills,

involving the ability to find, evaluate, and create information using digital tools. It includes navigating the internet, conducting online research, and effectively communicating and collaborating using digital platforms. Information management is another key competency within ICT. It involves skills in organizing, storing, retrieving, and analysing digital information. Individuals proficient in information management can efficiently use databases, spreadsheets, and file management systems to handle data effectively.

ICT skills enable individuals to communicate through various digital channels, such as email, instant messaging, video conferencing, and social media platforms. Effective communication skills in the digital realm involve writing clear and concise messages, adapting communication styles to different contexts, and engaging in online discussions and collaborations. ICT skills should include knowledge of cyber security threats, safe online practices, and data protection measures. Understanding how to protect personal and sensitive information, as well as using encryption and other security measures, is crucial to maintain digital security and privacy.

Proficiency in programming and coding is an emerging ICT skill that has gained prominence. Basic programming skills enable individuals to automate tasks, develop software applications, analyse data, and solve problems efficiently. Problem- solving and critical thinking are essential competencies within ICT. Individuals with these skills can analyse and solve problems using digital tools, employ logical reasoning, and troubleshoot hardware and software issues. They are also adept at adapting to new technologies and platforms. Digital creativity is another aspect of ICT skills. It involves using digital tools for graphic design, video editing, content creation, and multimedia production. Digital creativity allows individuals to express themselves and communicate their ideas in innovative and engaging ways.

Adaptability and a commitment to lifelong learning are crucial in the

ever- evolving field of ICT. Technology advances at a rapid pace, and ICT skills require individuals to adapt to new tools, platforms, and emerging trends. The ability to learn new skills and stay updated with the latest developments is vital for personal and professional growth in the digital age. ICT skills and competencies are indispensable in today's digital world. They empower individuals to navigate, utilize, and contribute to the digital landscape. Whether for personal use, education, or professional pursuits, ICT skills are fundamental for success in a society driven by information and communication technologies. ICT skills and competencies refer to the abilities and knowledge required to effectively use and navigate information and communication technologies (ICT). These skills encompass a wide range of areas and are essential in today's digital age. ICT skills pertain to the possession of the following skills:

1. **Operating System Proficiency:** The operating system is the information exchange between users and computers hardware to memory processes as well as software hardware and applications. An Operating system framework oversees programming, PC programs, and PC equipment. It also allows you to communicate with the computers to perform various functions such as arithmetic calculation and other significant tasks, without knowing how to speak the computer’s language. The operating system controls which process run, and it disunites them between different CPUs or cores, and multiple processes run in parallel. The Operating system firmware is a specific class of computer software that provides low-level control for a device’s specific hardware, that helps to manage all the hardware and other software on a computer. The operating system, also known as an “OS,” interfaces (Kumar, 2020). Since every computer today has an Operating System installed, the Operating System (OS) is crucial for users. Knowing how operating systems operate Understanding how file systems and disc scheduling operate also enables you to talk with a

computer without having any prior knowledge of its native tongue and recognising how hardware and software interact to give users the ability to communicate with the system and utilise its various resources is crucial to understanding this programme (Kumar, 2020). Basic computer skills involve familiarity with popular operating systems like Windows, macOS, or Linux. Users should be able to navigate the user interface, and use menus, icons, and file management features. This includes tasks such as creating, renaming, moving, and deleting files and folders.

2. **Desktop Publishing Skills:** Basic computer skills involve using word processing software like Microsoft Word or Google Docs. Users should be able to create and format documents, edit text, apply styles, and use features like spell-check and word count. Knowledge of spreadsheets is beneficial for tasks such as organizing data, performing calculations, and creating simple charts. Users should understand basic functions, formatting cells, and entering data accurately. Basic computer skills also include using presentation software like Microsoft PowerPoint or Google Slides. Users should be able to create slides, add content, apply formatting, insert images or multimedia, and deliver a presentation effectively. Word Processing refers to the act of using a computer to create, edit, save and print documents. In order to perform word processing, specialized software (known as a Word Processor) is needed. One example of a Word Processor is Microsoft Word, but other word-processing applications are also widely used. Examples include Microsoft Works Word Processor, Open Office Writer, Word Perfect, and Google Drive Document. These programs allow users to create a wide variety of documents including (but certainly not limited to) reports, letters, memos, newsletters and brochures. In addition to typing text, the word processor allows you to add content such as pictures, tables, and charts to your documents as well as decorative items

including borders and clipart. The editing and formatting capabilities of the word processor demonstrate the application's true power. Text can be inserted, edited, moved, copied, or deleted within your document and the appearance of the text can be modified in numerous ways. Most word processors also give you the ability to check your spelling and grammar and many have built-in dictionaries and other tools to assist you in your writing (Suny Broome Community College, 2019).

3. **File Management:** Understanding how to organize and manage files and folders is important. This includes creating folders, organizing files within them, and knowing how to search for and locate specific files. Basic file management skills also involve copying, moving, and deleting files as needed. Malak (2023) frames the concept of file management as, “File management refers to the process of organizing and storing information in an easily retrievable manner. It involves creating an organized structure for file storage and using computer storage devices, such as drives, to hold information. By implementing an effective file management system, businesses can reduce clutter, improve organization, and enhance productivity. The purpose of file management is to organize, store, and access electronic files efficiently and effectively. Good file management practices enable users to easily locate and retrieve the desired files, ensure data security, and optimize the use of storage space. Every digital file we generate or receive must be appropriately handled and saved in our system or using a cloud storage to save us time in finding the resource when we need it. The process of identifying and storing these data files inside a logical structure made up of directories and subdirectories should be handled with care.”

4. **Printing and Scanning:** Familiarity with basic printing and scanning functions is important. Users should know how to send documents to a printer, adjust print settings, and troubleshoot common printing issues.

Similarly, they should be able to use a scanner to digitize physical documents. Printing and scanning skills are important in various personal, educational, and professional contexts, they enable individuals to manage physical and digital documents effectively. Printing allows for the creation of hard copies of important documents, such as contracts, reports, or presentations, which can be easily stored, shared, and referenced offline. On the other hand, scanning allows individuals to convert physical documents into digital formats, making them easily searchable, editable, and shareable. These skills also facilitate information sharing and collaboration. Printed documents can be distributed among team members or clients during meetings, presentations, or workshops, enabling effective communication and collaboration. Scanned documents can be shared electronically, allowing for seamless collaboration and document exchange across locations and time zones. Printed documents offer accessibility and convenience in situations where digital access might be limited or impractical. For example, printed materials are useful in environments where electronic devices are restricted or where individuals prefer reading or annotating physical copies. Scanning documents provides a means to convert physical content into digital formats, making it accessible on various devices and enhancing portability. They are often necessary to comply with legal and regulatory requirements. Some legal processes, contracts, or official documentation may still require physical signatures or physical copies. Scanning allows for the creation of digital copies that can be securely stored and easily retrieved to meet legal or compliance obligations. Printing and scanning skills are important for efficient document management, information sharing, collaboration, accessibility, compliance, and cost-effectiveness. By mastering these skills, individuals can navigate both physical and digital document workflows, ensuring they can effectively handle a wide range of tasks in personal, educational, and professional settings.

5. **Basic Troubleshooting:** Kirvan and Zola (2022) explains that troubleshooting is a systematic approach to problem-solving that is often used to find and correct issues with complex machines, electronics, computers and software systems. The first step in most troubleshooting methods is gathering information on the issue, such as an undesired behaviour or a lack of expected functionality. Once the issue and how to reproduce it are understood, the next step is to eliminate unnecessary components to determine if the issue persists. This can help identify component incompatibility issues and problems caused by third-party products. Troubleshooting methodologies usually try to isolate a problem so that it can be examined. The initial goal is to diagnose the problem and try obvious solutions, such as performing a system reboot, powering down and up, and checking that the power cord is connected. Trouble-shooters initially look for common, known causes. For example, when a laptop won't boot up, an obvious first step is to check whether the power cable is working. Once common issues are ruled out, trouble-shooters must run through a checklist of components to identify where the failure is happening. The primary objectives of troubleshooting are to figure out why something doesn't work as intended and provide a solution to resolve the issue.

6. **Email Communication:** Proficiency in email usage is essential for personal and professional communication. Basic skills include composing and sending emails, managing an inbox, organizing emails into folders, attaching files, and replying to or forwarding messages.

7. **Digital Literacy:** Digital literacy refers to the ability to find, evaluate, use, and create information using digital technologies. It involves understanding how to navigate the internet, search for information, critically assess the credibility of online sources, and effectively communicate and collaborate using digital tools. Key sets of digital skills required to survive the digital environment include:

a) **Information Evaluation:** Digital literacy encompasses the ability to critically evaluate the credibility, accuracy, and reliability of online information. This skill involves assessing the source, checking for biases, verifying facts, and distinguishing between trustworthy and untrustworthy sources.

b) **Digital Security and Privacy:** Understanding digital security and privacy is crucial in the digital era. Digital literacy skills encompass knowledge of online threats, safe browsing practices, password management, data protection, and the ability to identify and respond to phishing attempts or other cybersecurity risks.

c) **Digital Citizenship:** Digital literacy involves being a responsible and ethical digital citizen. This includes understanding copyright and intellectual property rights, respecting online communities, practicing digital etiquette, and being aware of online behaviours that promote inclusivity, diversity, and digital well-being.

d) **Online Research Skills:** Digital literacy involves the ability to conduct effective online research. This includes using search engines effectively, employing advanced search techniques, evaluating and selecting appropriate sources, and citing and referencing digital content.

e) **Critical Thinking and Problem-Solving:** Digital literacy requires critical thinking and problem-solving skills. This involves analysing and interpreting information, solving technical issues, adapting to new technologies, and creatively applying digital tools to solve problems.

f) **Digital Health and Well-being:** Digital literacy includes understanding and managing digital health and well-being. This involves balancing screen time, practicing responsible digital

consumption, managing online relationships, and being aware of potential negative impacts of excessive technology use.

g) **Digital Communication Skills:** ICT has changed to course of communication styles with the introduction of many new social networking as well as communication applications so effective communication skills are essential in the digital era. Kaur (2021) remarked that, the Internet has paved out different mediums for personal as well as professional communication. Today, because of the advanced technology, a person from Japan can communicate with a person or group of persons in the USA, within no time. It is not only possible to make an audio call but also video conferencing can be made. This not only helps to communicate effectively but also saves the time of travelling. Along with this, it also gives a feeling of physical presence to those having communication over the Internet. There are various social media websites as well as applications through which people can easily share their views and opinions. On a personal note, they can share their well-being with each other. While on a professional note, they can interact with each other regarding job vacancies or even conduct career counselling. This clarifies that digitalization has contributed a lot to the people who want to indulge in long-distance communication in a short span of time. Apart from social media communication, there are modes like sending and receiving e-mails, communication over the organization server, etc. With the emerging necessity of sharing as well as communicating with people working within the same organization, the organizations are using the concept of Intranet, cloud computing, and distributed computing.

h) **Digital Security and Privacy:** As technology advances, the need for digital security and privacy awareness becomes crucial. ICT skills should encompass knowledge of cybersecurity threats,

safe online practices, data protection, and the ability to use encryption and other security measures to protect personal and sensitive information.

i) **Programming and Coding**: Basic programming and coding skills are increasingly valuable in various fields. Understanding programming concepts, languages, and algorithms allow individuals to automate tasks, develop software applications, analyse data, and solve problems efficiently.

j) **Digital Creativity:** The ability to creatively use digital tools for various purposes, such as graphic design, video editing, content creation, and multimedia production, is an essential competency in today's digital landscape.

1.7.1 Digital Literacy Global Framework (DLGF):

Digital Literacy Global Framework (DLGF) is a set of framework adopted by United Nations Education, Scientific and Cultural Organization in order to indicate the level of proficiency in digital literacy skills. This framework was published by UNESCO Institute of Statistics in 2018. Competence areas and competencies as given by DGLF is as follows:

Table 3.1 Digital Literacy Global Framework by UNESCOS

Competence Area	**Competencies**
Information & Data Literacy	1.1 Browsing, searching and filtering data, information and digital content 1.2 Evaluating data, information and digital content 1.3 Managing data, information and digital content
Communication & Collaboration	2.1 Interacting through digital technologies 2.2 Sharing through digital technologies 2.3 Engaging in citizenship through digital technologies 2.4 Collaborating through digital technologies 2.5 Netiquette 2.6 Managing digital identity
Digital Content Creation	3.1 Developing digital content 3.2 Integrating and re-elaborating digital content 3.3 Copyright and licenses 3.4 Programming
Safety	4.1 Protecting devices 4.2 Protecting personal data and privacy 4.3 Protecting health and well-being 4.4 Protecting the environment
Problem Solving	5.1 Solving technical problems 5.2 Identifying needs and technological responses 5.3 Creatively using digital technologies 5.4 Identifying digital competence gaps

Source: UNESCO official website

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4.1 Introduction

Data analysis is the process of examining and modelling data in order to determine useful information, draw conclusions, and support decision-making. It involves a variety of techniques and tools, including statistical analysis. The first step in data analysis is to collect the relevant data. This may involve data from surveys, experiments, or other sources. Once the data has been collected, it needs to be organized and refined to ensure that it is accurate and complete. This involves removing duplicates, correcting errors, or filling in missing values. Once the data has been cleaned and organized, various statistical techniques can be used to analyse it. For example, descriptive statistics can be used to summarize the data and identify patterns or trends.

In order to have more expressive insight to the given objective of the present study structured questionnaire was distributed and collected to have data pertaining to the objective of the study. This chapter will observe profoundly into these data so acquired and interpret the same for unveiling the underlying outcome. Data analysis involves several mathematical and statistical methods. MS Excel 2019 was mainly used for the purpose of data tabulation, interpretation and examination. The following data are acquired through survey questionnaire structured by the researcher. The questionnaire is developed in such a manner so as to produce comprehensive understanding towards the use of ICT facilities by the respondents, their ability to acquire valuable knowledge resources from the web domain, their capability to critically examine the qualitative degree of vast information on the internet.

4.2 Details of Respondents

Details of the respondents are collected in order to give better understanding of the various objective of the present study. The criteria selected for identifying the details are, designation, gender and age group.

4.2.1 Demographic profile of the respondents

Demographic profile of the respondents refers to the details of the faculty members who participate in the present study in terms of age group, gender and designation. The present study is conducted among faculty members of NEHU and MZU with the aim to have understanding on the level of their Information and

Communication (ICT) Skills and competencies. Structured questionnaire was designed in the view of the given objective and distributed among faculty members of NEHU and MZU. However, due to slight imbalance in the total number of faculty members in NEHU and MZU, the present study takes into account 75% of the total faculty strength from both the universities.

Table 4.1 Demographic distribution of the respondents

Sl. No	**Name of University**	**Total faculty strength**	**Total No. of Respondents**
1	NEHU	310	246 (75%)
2	MZU	237	160 (68%)
	Total	**541**	**406**

(Source: Annual Report of NEHU and MZU, 2019-2020)

Table 4.1 shows that out of the total 406 respondents, 246 respondents are from NEHU and 160 of them belong to MZU. In the case of NEHU 75% out of the total existing faculty members responded to the survey while 68% of the total faculty strength from MZU responded the survey. This data is presented in figure below to show clarity:

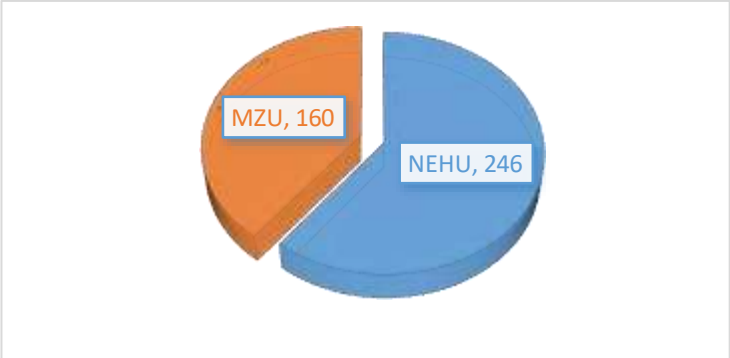


Figure 4.1: Distribution of respondents in NEHU & MZU

4.2.2 Respondents by designation

The present study utilise the designation of the respondents as one of the perimeter in the survey. The numbers of respondents were divided into three groups by their designations and presented in table below.

Table 4.2: Designation wise distribution of the respondents

Sl. No	Designation	NEHU (N= 246)	MZU (N= 160)	Total
1	Professor	77 (31%)	54 (34%)	131 (32%)
2	Associate Professor	80 (33%)	44 (27%)	124 (31%)
3	Assistant Professor	89 (36%)	62 (39%)	151 (37%)
	Total	**246**	**160**	**406**

Source: Primary Data

The data in hand reveals that in overall, in terms of designation out of the total respondents 37% are Assistant Professors, 32% are Professors and 31% of them are Associate Professors. As far as respondents from North Eastern Hills University (NEHU) are concerned, out of the total 246 respondents, 36% of them are Assistant Professor while 33% of them are Associate professor and 31% of them are Professor. Considering the data from Mizoram University (MZU) out of the total 160 respondents, 39% are Assistant Professor while 34% are Professor and 27% are Associate Professor.

Moreover, Majority of the respondents are Assistant professors both in North Eastern Hills University (NEHU) and Mizoram University (MZU) with 36% and 39% respectively. In the case of NEHU Associate Professors are the

second largest population of respondents with 33% followed by Professors with 31% whereas in Mizoram University Professors are the second largest population of respondents with 34% followed by Associate Professors with 27%. However not evenly distributed but it can be seen that the gap of margin between number of respondents in terms of designation is not very high.

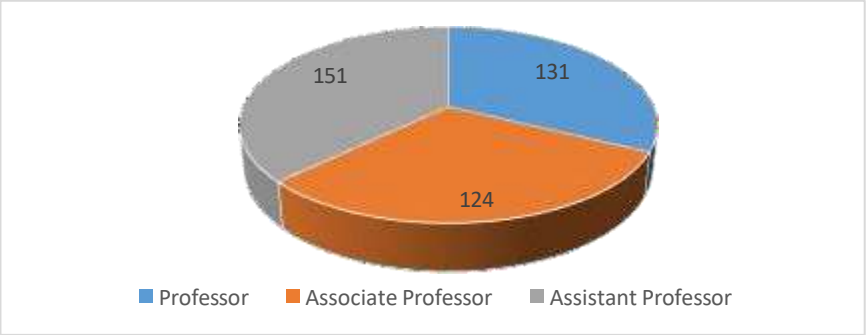


Figure 4.2: Designation of respondents

4.2.3 Respondents by Gender

Gender is very important element while studying use of e-resources or any other ICT based services. It is important that implications of ICT embrace both genders equally. The number of respondents was classified into male and female and shown data in table below. No separate survey was done for particular gender by both male and female are given the same questionnaire to solicit their claims.

Table 4.3: Gender wise distribution of the respondents

Sl. No	Gender	NEHU (N= 246)	MZU (N=160)	Total
1	Male	133 (54%)	78 (49%)	211 (52%)
2	Female	113 (46%)	82 (51%)	195 (48%)
	Total	**246**	**160**	**406**

(Source: Primary Data)

Table 4.3 represents that in the case of North Eastern Hills University (NEHU) 54% of the respondents are male and 46% of them are female while in Mizoram University (MZU) 51% of the respondents are female and 48% are male. Majority in male respondents can be seen in North Eastern Hills

University (NEHU) while in Mizoram University (MZU) the majority of the respondents are female.

Out of the total 406 respondents from both the universities 52% are male whereas 48% of them are female. However, the margin of gap between both genders is 16 numbers of respondents. The above data is presented in figure for more clarity as below:

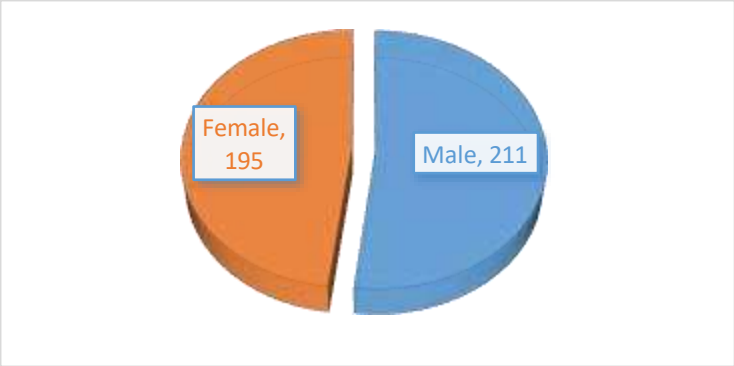


Figure 4.3: Respondents by gender

4.2.4 Respondents by Age Group

The following data in table shows number of respondents by age group.

Table 4.4: Age group of the respondents

Sl. No	Age Group	NEHU (N=246)	MZU (N=160)	Total
1	Less than 35 years	33 (13%)	32 (20%)	65 (16%)
2	Between 36-45 years	96 (39%)	46 (29%)	142 (35%)
3	Between 46-50 years	75 (31%)	44 (27%)	119 (29%)
4	50 years and above	42 (17%)	38 (24%)	80 (20%)
	Total	**246**	**160**	**406**

Source: Primary Data

Table 4.4 shows that the pattern of response for all age group remains identical in both the university taken into study. North Eastern Hills University (NEHU) out of the total 246 respondents majority of them i.e. 39% are in the age group of between 36- 45 years similarly in the case of Mizoram University majority of the respondents are from the same age group which contribute 29%

of the total 160 respondents. The age group of 46 - 50 years attain the second highest response i.e. 31% and 27% from NEHU and MZU respectively, followed by the age group of 50 and above with 17% from NEHU and 24% from MZU. The defined age group with least response is the age group of Less than 35 years, with 13% from NEHU and 20% from MZU, this fact highlights the lower age standard for recruitment into central universities in both the universities in particular and India in general.

In overall cases, out of the total 406 respondents from both North Eastern Hills University (NEHU) and Mizoram University (MZU) majority of the respondents i.e. 35% are between the ages of 36-45 years, followed by the age of 46-50 years which contributes 29% of the respondents. The age group of 50 years and above constitute 20 % of the respondents. The least respondents are the age group of Less than 35 years i.e., only 16%, which is also the youngest age group provided within the parameter.

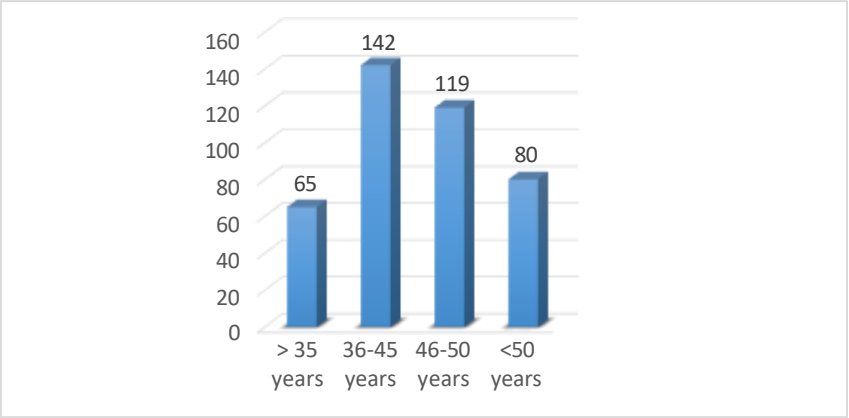


Figure 4.4: Age group of respondents

4.3 Frequency and purpose of using e-resource

Survey was conducted so as to reveal the duration of times a respondent spent on the computer daily, the permanence of using ICT allied services, factors supporting their use of ICT based services and capability of utilising such knowledge resources to it optimum is also surveyed.

4.3.1 Frequency of using computer by faculty members in NEHU and MZU

In order to realise the utilization of web-based knowledge resources frequency of using computers was regarded as a crucial factor. The hour wise utilization of computers by the faculty members of both the university is given.

Table 4.5: Designation wise frequency of using computer in NEHU and MZU

Sl. No	Level of Frequency	Professor (N=131)	Associate Professor (N= 124)	Assistant Professor (N=151)
1	Below 2 hours	26 (10%)	16 (13%)	33 (22%)
2	2-4 hours	44 (34%)	29 (23%)	68 (45%)
3	Over 5 hours	37 (28%)	48 (39%)	23 (15%)
4	Undecided	24 (18%)	31 (25%)	27 (18%)
	Total	**131**	**124**	**151**

Source: Primary Data

Analysis of the data given Table 4.5 indicates the designation wise frequency of using computers among faculty members of NEHU and MZU. It is found that out of total 131 Professors who participated in the present study majority of the respondents i.e. 34% use a computer for 2-4 hours daily while 28% of the respondents use it for over 5 hours, 18% of the respondents remain undecided to the frequency of their daily computer usage and only 10% of the respondents use a computers for below 2 hours daily.

Out of the total 124 Associate Professors 39% of them use computer for over 5 hours daily while 25% of the respondents remain undecided toward the frequency of their daily computer usage and 23% of the respondents use a computer for 2-4 hours daily while only 13% of the of the respondents use computer for below 2 hours daily and a total of 151 Assistant Professors participated in the present study and the data in hand indicates that majority of them i.e. 45% use a computer for 2-4 hours daily and 22% of them use it for below 2 hours daily while 18% of the respondents remain undecided on their daily frequency of computer usage and 15% of the respondents use a computer for over 5 hours daily. This data is presented in figure below.

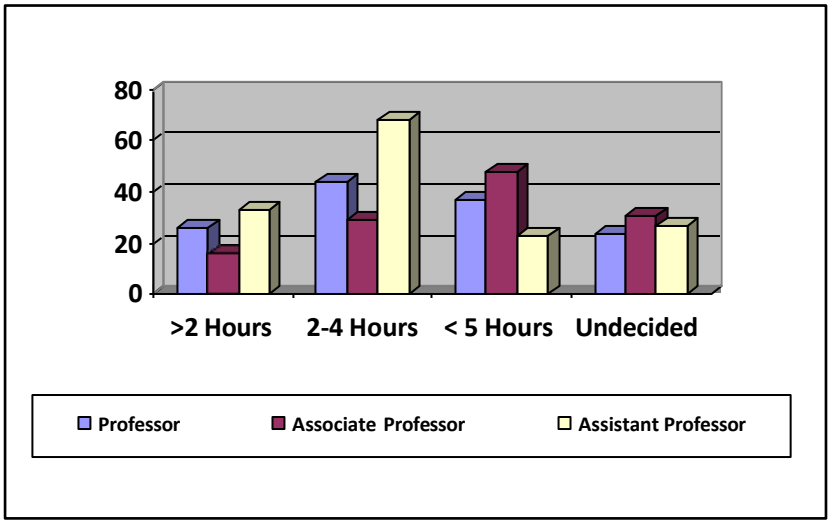


Figure 4.5: Frequency of using computer by faculty of NEHU & MZU

4.3.2 Permanence of using e-resources in NEHU and MZU

The use of electronic resources by university teachers has evolved over several decades, with a notable increase in recent years yet today, it is standard practice for university teachers to leverage electronic resources for course materials, research, and communication with students. The exact timeline can vary across institutions and disciplines, but the trend toward digitalization in education has been ongoing for several decades. The permanence of using e-resources is studied based on their time of initial usage of e-resources for academic purpose. E-resources is a wide range of electronic based knowledge resources including, textual, image, audio recordings or video provided through social networking sites or DTH based educational videos.

Table 4.6: Permanence of using e-resources

Sl. No	Time	NEHU	MZU	Total
1	Since High School	12 (5%)	10 (6%)	22 (6%)
2	Since H/S school	8 (4%)	10 (6%)	18 (4%)
3	Since College	33 (13%)	25 (16%)	58 (14%)
4	Since University	82 (33%)	33 (21%)	115 (28%)
5	At professional career	111 (45%)	82 (51%)	193 (48%)
	Total	**246**	**160**	**406**

Source: Primary Data

Table 4.6 shows that most of the respondents started using e-resources a bit late in their career. In the case of North Eastern Hills University (NEHU) majority of the respondents (45%) started using e-resources after following professional career and similarly in Mizoram University (MZU) majority of the respondents i.e. 51% started to use e-resources after following their professional career, which is followed by respondents who started to use e-resources since university with 33% and 21% in NEHU and MZU respectively, both in NEHU and MZU 13% and 16% of them respectively stared using e-resources since college. It can be seen that very few respondents started using e-resources since school as only 4% and 6% of both NEHU and MZU respectively started using e-resources in Higher Secondary School and 5% and 6% both from NEHU and MZU respectively started using e-resources at High School level.

In the overall case out of total 406 respondents from both the Universities majority of the respondents i.e., 48% started using e-resources only after following their professional career. 28% of the respondents started using e-resources since university, 14% of them started in college while 6% of the respondents started using e-resources since Higher Secondary School and only 4% of the respondents from both University use e-resources since High School level respectively. It can be assumed that the use of e-resources can be adversely affected by the understanding of the concept of e-resources. Understanding the true concept and scope of e-resources can highly determine the use of e-resources. This is presented in figure below for better clarity.

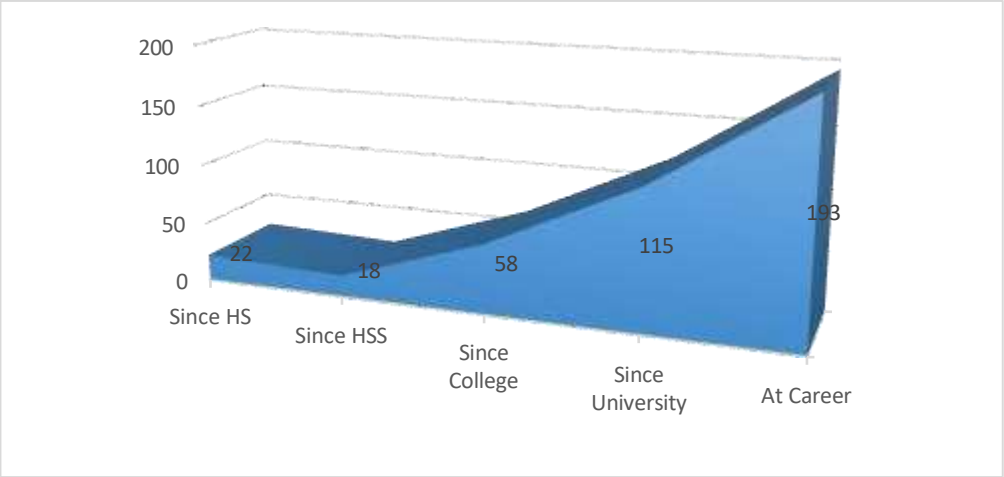


Table 4.6 Permanence of using computer

4.3.3 Frequency of using various e-resources

The frequency of using e-resources by university teachers can vary widely based on factors such as the discipline, the individual preferences and practices of teachers, the availability of technology, and the institutional resources. The specific frequency of using e-resources can vary among teachers and institutions. Some educators may fully embrace digital tools and resources, while others may use them more selectively. Additionally, the level of technological infrastructure and support within an institution can influence how frequently e-resources are integrated into teaching and research activities.

Study was made to identify the frequency of using various forms of e-resources. Forms of e-resources selected for the present study includes e-books, e- journals, CD ROM sources, audio sources and video sources. There are several forms are e-books whose use have depleted over the course of time but in the digital age it is rather a change of form or format. The primary data collected by the scholar is presented in table below:

Table 4.7: Frequency of using various e-resources

Sl. No	E-Resources	Frequency	NEHU (N=246)	MZU (N= 160)	Total
1	E-books	Never	17 (7%)	8 (5%)	25 (6%)
		Rarely	35 (14%)	15 (9%)	50 (12%)
		Sometimes	101 (41%)	31 (19%)	132 (33%)
		Often	75 (31%)	84 (53%)	159 (39%)
		Always	18 (7%)	22 (14%)	40 (10%)
2	E-Journals	Never	12 (5%)	6 (3%)	18 (5%)
		Rarely	44 (18%)	14 (9%)	58 (14%)
		Sometimes	70 (28%)	16 (10)	86 (21%)
		Often	54 (22%)	27 (17%)	81 (20%)
		Always	66 (27%)	97 (61%)	163 (40%)
3	CD ROM	Never	126 (51%)	75 (47%)	201 (50%)
		Rarely	92 (37%)	66 (41%)	158 (39%)
		Sometimes	22 (9%)	11 (7%)	33 (8%)
		Often	6 (3%)	8 (5%)	14 (3%)
		Always	-	-	-
4	Database	Never	18 (8%)	7 (4%)	25 (6%)
		Rarely	23 (9%)	48 (30%)	71 (17%)
		Sometimes	77 (31%)	59 (37%)	136 (34%)
		Often	86 (35%)	36 (23%)	122 (30%)
		Always	42 (17%)	10 (6%)	52 (13%)
5	Audio Source	Never	55 (22%)	19 (12%)	74 (18%)
		Rarely	59 (24%)	44 (27%)	103 (25%)
		Sometimes	73 (30%)	49 (31%)	122 (30%)
		Often	45 (18%)	36 (23%)	81 (20%)
		Always	14 (6%)	12 (7%)	26 (7%)
6	Video Source	Never	17 (7%)	14 (9%)	31 (8%)
		Rarely	38 (15%)	11 (7%)	49 (12%)
		Sometimes	72 (29%)	52 (33%)	124 (30%)
		Often	75 (31%)	63 (39%)	138 (34%)
		Always	44 (18%)	20 (12%)	64 (16%)

(Source: Primary Data)

Analysis of data represented at Table 4.7 throw lights to the following information:

1. E-Books: When measured according to Likert 5-point scale of frequency it can be observed that in NEHU, out of the total 246 respondents, 41% of them use e-books sometimes and 31% of them claims to have often use e-books while 14% of the respondents rarely use e-books and the number of respondents who claim to never and always use e-books are 7% respectively.In the case of MZU when measured using the same scale more than half of the respondents i.e. 53% often use e-books and 19% of them use it sometimes. 14% of the respondents are known to always use e-books while 9% of them rarely use it and 5% of the respondents from MZU never use e-books.

Out of the total 406 respondents from both NEHU and MZU it can be seen that 39% of the respondents often use E-Books, 33% of them use it sometimes, 12% of them rarely use it and 10% of them always use it, only 6% of the respondents never use e-books

2. E-Journals:

In NEHU out of the total 246 respondents, 28% of the respondents use e- journals sometimes, 27% of the respondents always use e-journals and 22% of them use it often. 18% of the respondents rarely use e-journals while only 5% of the respondents never use e-journals.

In the case of MZU, out of the total 160 respondents, 61% of the respondents always use e-journals while 17% of the respondents often use e-journals and 10% of them use it sometimes. 9% of the respondents rarely use e-journals and only 3% of the respondents never use e-journals.

Out of the total 406 respondents from both NEHU and MZU it can be seen that 40% of the respondents always use E-Books, 20% of them often use it, 21% of them sometimes use it and 14% of them rarely use e-books while only 5% of the respondents never use e-books.

3. CD ROM Sources:

In NEHU out of the total 246 respondents more than half i.e. 51% of the respondents never use CD ROM sources while 37% of the respondents rarely use the same. 9% of the total respondents use it sometimes and only 3%

of the respondents often use CD ROM sources and no respondents always use CD ROM.

In MZU, out of the total 160 respondents 47% of the respondents never use CD ROM sources while 41% of the respondents rarely use it. Out of the total respondents 10% of them claim to use it sometimes while 5% of the respondents often use e- journals and no respondents claimed to always use CD ROM sources.

Use of CD ROM source as knowledge resources seems to be less prominent. Out of the total 406 respondents from both NEHU and MZU 50% of the respondents never use CD ROM sources and 39% of them rarely use it, 8% of the respondents claim to use CD ROM sources sometimes and 3% of them often use it while there are no respondents who always use CD ROM sources.

4. Online Database:

Out of the total 246 respondents from NEHU 35% of them often use online database and 31% of them use online databases sometimes. 17% of the respondents always use online database, 9% of them rarely use it and 8% of them never use online database.

In MZU, 37% out of the total 160 respondents use online database sometimes and 30% of them rarely use it while 23% of the respondents often use online database. 6% of the respondents always use online database and only 4% out of the total respondents never use online database.

Out of the total respondents 406 from both universities taken for study 34% of the respondents use online database sometimes and 30% of them often use online database. It is realized that 17% of the respondents rarely use online database while 13% always use it and only 6% of the respondents never use online database.

5. Audio Sources:

In the case of NEHU 30% of the total 246 respondents use audio

sources sometimes while 24% of them rarely use it. 22% of the respondents never use audio sources, 18% of them often use it and only 6% out of the total respondents always use audio sources.

In MZU, out of the total 160 respondents 31% of the respondents use audio sources sometimes and 27% of them rarely use it. 23% of them often use audio sources while 12% of them never use audio sources and only 7% of the respondents always use audio sources.

30% out of the total 406 respondents from both NEHU and MZU use audio sources sometimes and 25% of them rarely use it. It is identified that 20% of the respondents often use audio sources while 18% of the respondents rarely use it and only 7% of the respondents always use audio sources.

6. Video Sources:

In NEHU 31% out of 246 respondents often use audio sources while 29% of them use video sources sometimes and 18% of the respondents always use video sources, while 15% of them rarely use it and only 7% out of the total respondents never use video sources.

In MZU, out of the total 160 respondents 39% of the respondents often use video sources whereas 33% of them use video sources sometimes and 12% of respondents always use video sources while 9% of them never use audio sources and only 7% of the respondents rarely use video sources.

34% among the total 406 respondents from both universities often use video sources and 30% of them sometimes use video sources. It is revealed that 16% of the respondents always use video sources while 12% of the respondents rarely use it and only 8% of them never use video sources.

4.3.4 Designation-wise purpose of using e-resources

A designation-wise survey refers to a survey conducted with the specific purpose of gathering information or feedback from individuals based on their job titles or roles within an organization. The designation or job title serves as a categorization criterion, allowing for the analysis of data based on

different roles and responsibilities within the organisation. The purpose of conducting a designation-wise survey can vary depending on the goals of the organization or researchers involved. A survey focused on job titles can reveal specific skill gaps or training needs within different departments or roles. This information can be valuable for designing targeted training programs to enhance employee skills and performance.

Organizations can conduct designation-wise surveys to gauge the satisfaction levels of employees in different roles. This can help identify areas of improvement or highlight aspects of the work environment that are particularly positive or negative for specific job functions.

The present study intends to highlight the purpose for using e-resources by the faculty members of both the universities. As the following study is conducted among faculty members it is assumed that they utilise e-resources primarily to enhance their profession. Although it is very likely that they use e-resources for other purpose as well but the study is concentrated on the extent of their use of e-resources in their professional development. Data collected from the respondents were tabulated below for interpretation.

Table 4.8: Designation-wise purpose of using e-resource

SL. No	Purpose	Professor (N=131)	Associate Professor (N=124)	Assistant Professor (N=151)
1	To prepare for teaching	46 (35%)	51 (41%)	30 (20%)
2	To update knowledge	38 (29%)	22 (18%)	21 (14%)
3	To write research papers	28 (22%)	29 (23%)	87 (57%)
4	To become Lifelong learner	19 (14%)	22 (18%)	13 (9%)
	Total	**131**	**124**	**151**

Source: Primary data

Table 4.8 shows that out of the total 131 Professors of NEHU and MZU who participated in the present study 35% of them mainly use e-resources to prepare for teaching, 29% of them use it to update their knowledge. 22% use

the same to write research papers and 14% of the respondents use e-resources to become lifelong learner.

Out of the total 123 Associate Professors 41% of them use e-resources to prepare for teaching, 23% of the respondents use the same to write research papers and those who use e-resources to update knowledge and t5o become lifelong learners are equally 18% each.

Out of the total 151 Assistant Professors majority of them i.e. 57% use e- resources to write research papers, 20% of them use it to prepare for teaching, 14% of them use it to update knowledge and only 9% of the respondents use e-resources to become lifelong learner. The following figure represents the above data.

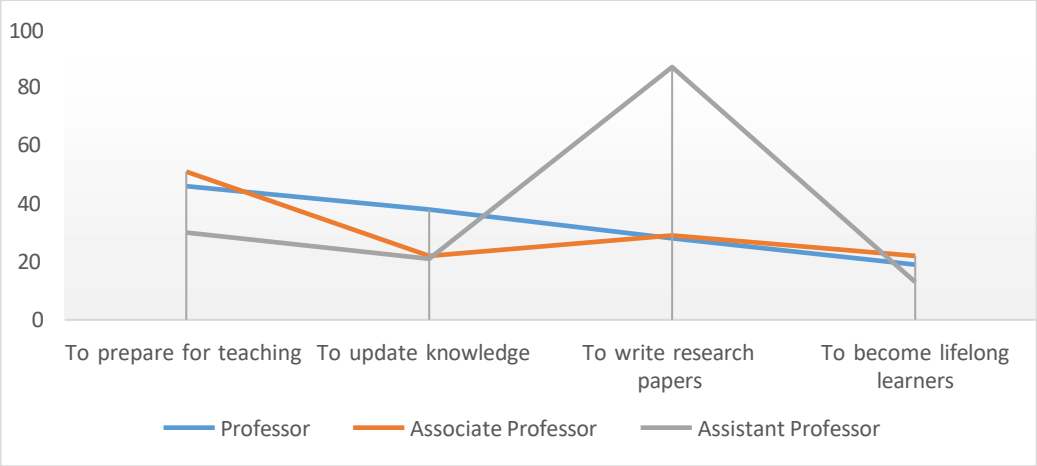


Figure 4.7: Designation wise purpose of using e-resource

4.3.5 Reason for opting e-resources

There are several reasons as to why an individual can decide to use e-resources over the traditional resources, which include time taken for access, availability of remote access, more accurate and updated information and round the clock access. The present study highlights the reason why the respondents choose to use e-resources.

Table 4.9: Reason for using e-resource

Sl. No	*Reason*	*NEHU (N=246)*	*MZU (N=160)*	*Total*
1	Speed of access	67 (28%)	34 (21%)	101 (25%)
2	Remote access	66 (27%)	77 (48%)	143 (35%)
3	Updated information	64 (26%)	37 (23%)	101 (25%)
4	Timeless access	49 (19%)	12 (8%)	61 (15%)
	Total	246	160	406

Source: Primary data

Table 4 shows that in the case of NEHU very less margin of gap can be seen between the options of the respondents. 28% of the respondents use e-resources for its speed of access, 27% of the respondents use e-resources for its remote access features, 26% opted e-resources for its updated information and 19% of the respondents use e- resources for its timeless access.

While in MZU, majority of the respondents i.e. 48% use e-resources for its remote access features, 23% of the respondents use it for is updated information, 21% use e-resources for its speed of access and a few respondents i.e. 8% use e-resources for its timeless all round the clock accessibility.

In the overall scenario, majority of the respondents i.e. 35% choose to use e- resources for its ability of remote access. The same number of respondents i.e. 25% each opted to use e-resources for its speed and updated while 15% of the respondents decided to use e-resources for its timeless, round the clock access.

4.3.6 Age Group wise device opt for accessing e-resources

In order to find out the use pattern of e-resources the present study intends to throw light on the device used by the respondents to access e-resources. However, e- resources are not stand alone knowledge resource they required electronic devices in order to access them, these electronic devices may include, Desktop computers, laptop computers, mobile phone and tablets. The following data in table shows responses of the respondents.

Table 4.10: Age-group wise device opt for accessing e-resources

Sl. No	Device	Age Group			
		< 35 years (N= 65)	**36-45 years (N=142)**	**46-50 years (N=119)**	**> 50 years (N= 80)**
1	Laptop	23 (35%)	63 (44%)	47 (39%)	32 (40%)
2	Desktop	11 (17%)	43 (30%)	31 (26%)	19 (24%)
3	Smart phone	22 (34%)	24 (17%)	22 (18%)	18 (23%)
4	Tablet	9 (14%)	12 (9%)	19 (13%)	11 (14%)
	Total	**65**	**142**	**119**	**80**

Source: Primary data

Table 4.10 shows the age group wise preference of electronic devices for accessing e-resources by faculty members of NEHU and MZU. Out of the total 65 respondents who belong to the3 age group of less than 35 years majority of the respondents i.e. 35% prefer to access e-resources through laptop and 34% of them prefer to use smart phones, 17% of them prefer desktop and 14% of them prefer to use tablets.

Out of the total 142 respondents who belong to the age group of 36-45 years 44% of them prefer to use laptop for accessing e-resources, 30% of them prefer desktop, 17% of them prefer smart phone and 9% of them prefer to use tablet for accessing e-resource.

Among 119 respondents who belong to the age group of 46-50 years of age 39% of the respondents prefer to use laptop for accessing e-resources while 26% of them prefer to use desktop, 18% of them prefer to use smart phones and 13% of the respondents prefer to use tablet for accessing e-resources.

Out of the total 80 respondents who belong to the age group of 50 and above 40% of them prefer to use laptop for accessing e-resources, 24% of them prefer to use desktop, 23% of them prefer to use smartphones and 14% of them prefer to access e- resources through tablet.

4.3.7 Most frequently used e-database in NEHU and MZU

The present study intended to highlight the most used online database by the respondents. The following table depicts the attitudes of the respondents in this regards.

Table 4.11: frequently used e- databases

Sl. No	Online databases	NEHU (N=246)	MZU (N=160)	Total
1	JSTOR	81 (33%)	65 (41%)	146 (36%)
2	Elsevier	66 (27%)	44 (28%)	110 (27%)
3	Springer	64 (26%)	26 (16%)	90 (22%)
4	Wiley online library	35 (14%)	25 (15%)	60 (15%)
	Total	**246**	**160**	**406**

Source: Primary data

Data available at table 4.11 shows that in NEHU and MZU 33% and 41% respectively claims that JSTOR is their mostly used database, 27% and 28% respectively claims that Elsevier is their mostly used database, 26% and 16% respectively mostly use Springer database and 14% and 15% respectively marks Wiley online library as their mostly used database.

In the overall scenario, JSTOR is the most widely used online database with 36% of the respondents claiming it as their mostly used online database. 27% of the respondents claim that Elsevier is their mostly used online database, 22% claims that Springer is their mostly used online database and 15% claims that Wiley online library is their mostly used online database. The following figure shows the above data.

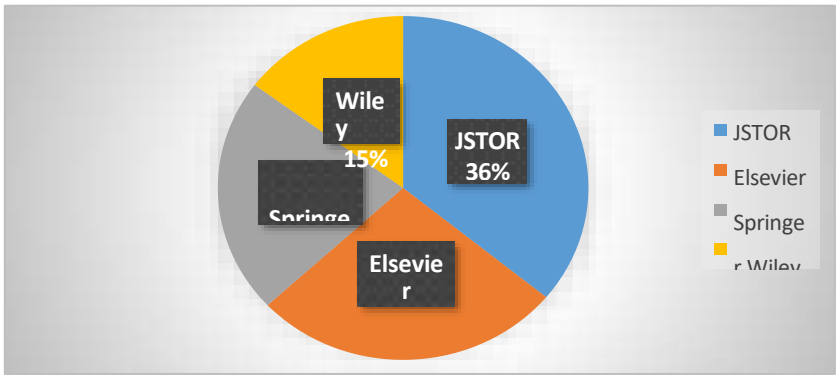


Figure 4.8: Frequently used databases in NEHU & MZU

4.4 Skills and competencies in using e-resources

Faculty members at universities require a range of skills and competencies to effectively use e-resources in their teaching, research, and professional activities. These skills and competencies contribute to the effective integration of e-resources into various aspects of academic work, supporting faculty members in their roles as educators, researchers, and contributors to the academic community.

The present study intends to highlight the level of skill and competency of faculty members of both the universities in of accessing e-resources. In order to find out their skills and competencies queries were made on their level of skills in browsing through the web, frequently used web browser, frequently used search engines, the knowhow of switching search engines based on the nature of search, use of OPAC facilities provided by the library, etc.

4.4.1 Skills in browsing through the web

For the efficient utilization of e-resources it is very important to have the skills to browse through the multitude of information over the internet. Data collected form the respondents is placed below in table in this regard.

Table 4.12: Skills in browsing through the web based on designation

Sl. No	Level of skills	Professor (N=131)	Associate Professor (N=124)	Assistant Professor (N=151)
1	Very poor	12 (9%)	17 (14%)	17 (11%)
2	Poor	18 (14%)	16 (13%)	21 (14)
3	Fair	35 (27%)	24 (19%)	36 (24%)
4	Good	46 (35%)	45 (36%)	53 (35%)
5	Excellent	20 (15%)	22 (18%)	24 (16%)
	Total	**131**	**124**	**151**

Source: Primary data

Table 4.12 indicates that out of the total 131 Professors who participated in the present study 35% of them claims that they have good skills in browsing through the web, 27% of them claims that they have fair skill, 15% of them have excellent skill, 14% of them claims that they have poor skills and 9% of the respondents claim that they have very poor skills in browsing through the web. Out of the total 124 Associate Professors who participated in the present study 36% of them claim that they have good skills, 19% of them have fair skills, 18% of them have excellent skills while 14% of them claims that they have very poor skills and 13% of them claims that they have poor skills in browsing through the web. Among the total 151 Assistant Professors 35% of them have good skills in browsing through the web, 24% of them have fair skills, 16% of them have excellent skills, 14% of them have poor skills and 11% of the respondents claims that they have very poor skills in browsing through the web.

4.4.2 Use of web browsers

Table 4.13 shows the frequency of using various browsers by faculty members of NEHU and MZU

Table 4.13: Frequently used web-browsers

Sl. No	Name of Browsers	NEHU	MZU	Total
1	Google Chrome	134 (54%)	110 (68%)	244 (60%)
2	Firefox	34 (14%)	16 (10%)	35 (8%)
3	Internet Explorer	19 (8%)	3 (2%)	37 (9%)
4	Microsoft Edge	53 (22%)	30 (19%)	83 (21%)
5	Others	6 (2%)	1 (1%)	7 (2%)
	Total	**246**	**160**	**406**

Source: Primary data

Table 4.13 shows that both in NEHU and MZU the use pattern of these browsers are similar, Google Chrome is the most commonly used web browsers with 135 (54%) and 110 (68%) users from NEHU and MZU respectively. Microsoft Edge claims to be the second most commonly used web browsers with 53 (22%) and 30 (19%) users in NEHU and MZU respectively. Firefox is the third mostly used browsers with 34 (14%) and 16

(10%) user in NEHU and MZU respectively. Internet Explorer is the least used browser with only 19 (8%) and 3 (2%) users both in NEHU and MZU. Only 6 (2%) and 1 (1%) opted to use any other browser as their main web browser.

In the overall cases, more than half of the respondents from NEHU and MZU i.e. 60% used Google Chrome as their main browser, which is ultimately the most commonly used web browser for browsing the internet. The second most commonly used browser is Microsoft Edge with 21% of the total respondents using it as their main web browser. Use of other mentioned we browser is relatively low with 9% of the respondents using Internet Explorer, 8% of the respondents are using Firefox and only 2% of the respondents are using Other browsers.

4.4.3 Familiarity with various search engines

The familiarity of search engines by the respondents is given below

Table 4.14: Familiarity with search engines

S. No	Search Engines	NEHU (N=246)		MZU (N=160)		Total
1	Google.com	Low	5 (2%)	Low	NIL	5 (1%)
		Average	10 (4%)	Average	13 (8%)	23 (6%)
		High	231 (94%)	High	147 (92%)	378 (93%)
		Total	**246**	**Total**	**160**	**406**
2	MSN.com	Low	76 (31%)	Low	21 (13%)	97 (24%)
		Average	121 (49%)	Average	108 (68%)	229 (56%)
		High	49 (20%)	High	31 (19%)	80 (20%)
		Total	**246**	**Total**	**160**	**406**
3	Bing	Low	52 (21%)	Low	89 (56%)	141 (35%)
		Average	161 (66%)	Average	63 (39%)	224 (55%)
		High	33 (13%)	High	8 (5%)	41 (10%)
		Total	**246**	**Total**	**160**	**406**
4	Yahoo.com	Low	22 (9%)	Low	35 (22%)	57 (14%)
		Average	208 (85%)	Average	123 (77%)	331 (82%)
		High	16 (6%)	High	2 (1%)	18 (4%)
		Total	**246**	**Total**	**106**	**406**

Source: Primary data

Table 4.14 shows that over two-thirds of the respondents in NEHU (94%) have a high level of knowledge with Google.com, compared to 10% who have a medium level of familiarity and 2% who have a low level. Almost

half of respondents, or 49%, have average degree of acquaintance with MSN.com, compared to 31% who have low familiarity and 20% who have high familiarity. More than half i.e. 66% of the respondents from NEHU are averagely familiar with Microsoft Bing while 21% have low familiarity and 13% are highly familiar with Microsoft Bing. Further analysis shows that 85% of the respondents have average familiarity with Yahoo.com while 9% have low familiarity and only 6% of the respondents are highly familiar with yahoo.com.

In the case of MZU 92% of the respondents are highly familiar with Google.com while 6% of them are averagely familiar and only 1% is lowly familiar. More than half of the respondents from MZU i.e. 68% are averagely familiar with MSN.com, 13% have low familiarity with MSN.com and 19% are highly familiar. When it comes to Microsoft Bing 56% of the respondents from MZU have very low familiarity level while 39% of them have average familiarity level 5% of the respondents have low familiarity level. In MZU 77% of the respondents are average familiar with Yahoo.com while 22% of them have low familiarity level and only 1% of the respondents is highly familiar with yahoo.com.

Out of the total respondents from both NEHU and MZU two-third of the respondents (93%) are highly familiar with Google.com. 6% of them are familiar on average level and only 1% have low familiarity. More than half of the respondents (56%) are average familiar with MSN.com while 20% of them are highly familiar with MSN.com and 24% have low familiarity. When it comes to Microsoft Bing only 10% of the respondents are highly familiar while 35% of them have low familiarity and 55% of them are averagely familiar. In the case of Yahoo.com 82% of the respondents are averagely familiar, 14% have low familiarity and only 4% of the respondents are highly familiar.

4.4.4 Switching of search engines

Switching search engines is a very simple process. Various search engines have different characteristics and different capabilities and different search engines use distinct algorithms to generate search results. Switching allows you to experience alternative methods for indexing and ranking information, potentially yielding more relevant results based on your search queries. Certain search engines are designed for specific types of content. For example, there are search engines focused on academic literature, images, videos, or privacy-centric searches. The present study implies to highlight the knowledge of the respondents regarding use of search engines based on the nature of information research over the web or any task wish to execute online. Collected data from respondents in this regard is place below.

Table 4.15: Switching search engines based on the nature of search

Sl. No	Response	NEHU (N=246)	MZU (N=160)	Total
1	Yes	158 (64%)	94 (59%)	252 (62%)
2	No	88 (36%)	66 (41%)	154 (38%)
	Total	**246**	**160**	**406**

Source: Primary data

Table 4.15 shows that in NEHU, more than half i.e. 64% have change their search engines according to the nature of their search while 36% have never done this task. In MZU, 59% of the respondents have changed their browsers according to their search while 41% of them haven't performed this task. Out of the total 406 respondents from both NEHU and MZU 62% of them have the ability to switch their search engines based on the nature of their search while 38% haven't change their search engines based on the nature of their search.

4.4.5 Use of OPAC facilities

OPAC facilities provide comfortable research and retrieval facilities for library users, this facility is both provide at NEHU and MZU central library.

The following data in table shows gender-based use of OPAC facilities on the respondents.

Table 4.16: Gender based use of OPAC Facilities

Sl. No	Response	Male (N= 211)	Female (N=195)	Total (N=406)
1	Yes	171 (81%)	144 (74%)	315 (77%)
2	No	40 (19%)	51 (26%)	91 (23%)
	Total	**211**	**195**	**406**

Source: Primary data

Table 4.16 shows that out of total 211 male respondents 81% of them claims that they used OPAC facilities provided by the library while 19% of them claim that they do not use the OPAC facilities. Out of the total 195 female respondents 74% claim that they use the OPAC facilities provided by the library while 26% of the respondents say that they do not use the OPAC facilities provided by the library.

In the over-all scenario, out of the total 406 respondents 77% of them claim that they use the OPAC facilities while 23% of them claim that they do not use the OPAC facilities.

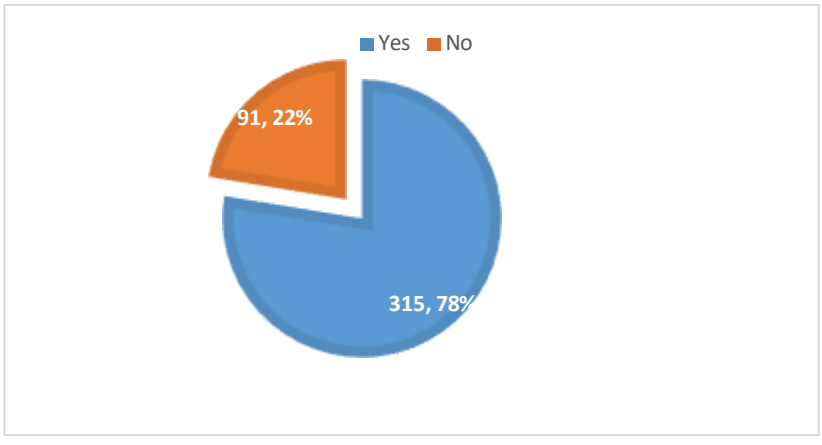


Figure 4.9: Faculty use of OPAC at NEHU & MZU

4.4.6 Use of OPAC search value in NEHU and MZU

OPAC facility provides several search value including Author, Title, Keywords, Publishers, ISBN/ISSN. The following data in table shows use of

OPAC search value from the respondents.

Table 4.17: Use of search value on the OPAC

Sl. No	Search Value	NEHU (N=246)	MZU (N=160)	Total
1	Author	56 (23%)	27 (17%)	83 (21%)
2	Title	108 (44%)	96 (60%)	204 (50%)
3	Keywords	53 (21%)	23 (14%)	76 (19%)
4	Publishers	17 (7%)	8 (5%)	25 (6%)
5	ISBN/ISSN	12 (5%)	6 (4%)	18 (4%)
	Total	**246**	**160**	**406**

Source: Primary data

Table 4.17 shows that in NEHU, majority of the respondents i.e. 44% are using title of the documents as search value while 23% are using the Author value. 21% are using Keywords, 7% are using Publishers and 5% are using ISBN/ISSN as their search value. In MZU, majority of the respondents i.e. 60% are using Title value to search their desired documents and 17% of them are using Author value to search their documents while 14% of them are using Keywords for the same purpose. 5% of the respondents prefer to search their documents through Publishers while only 4% of them are using ISBN/ISSN as their search value. Out of the total 406 respondents from both the university half of the respondents i.e. 50% are using Title to search their desired documents while 21% of them are using the Author value. 19% of the respondents are using Keywords as their search value to locate their desired documents, 6% of the respondents search their desired documents through publishers and 4% of them are using ISBN/ISSN to locate their documents.

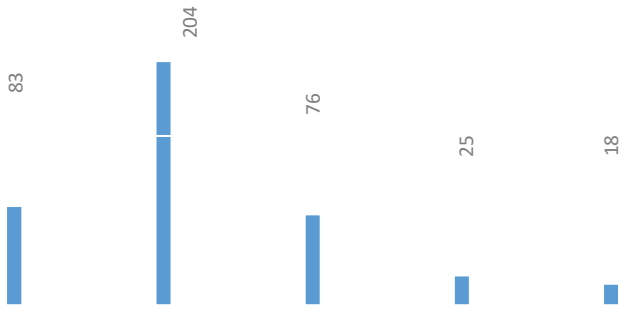


Figure 4.10: Showing use of OPAC search values in NEHU & MZU

4.4.7 Use of search techniques

Search techniques refer to the procedure used for browsing through database or the web, refining search queries and experimenting with different techniques can significantly improve the accuracy and relevance of your search results. The present study implies to highlight the use of various search techniques namely, Simple Keywords, Boolean Operators, Truncation, Field Search.

Table 4.18: Search technique used for browsing

Sl. No	Search Techniques	NEHU (N=246)	MZU (N=160)	Total
1	Simple keyword	107 (44%)	74 (46%)	181 (45%)
2	Boolean Operators	67 (27%)	43 (27%)	110 (27%)
3	Truncation	33 (13%)	30 (19%)	63 (15%)
4	Field Search	39 (16%)	13 (8%)	52 (13%)
	Total	**246**	**160**	**406**

Source: Primary data

Table 4.18 shows that in NEHU, almost half of the respondents i.e. 44% are using Simple Keywords search while 27% are using Boolean Operators, 16% are using Field Search techniques and 13% of the respondents are using Truncation based search.

In the case of MZU, most of the respondents i.e. 45% are using Simple Keyword search while 27% of them are using Boolean Operators and 15% of the respondents are using Truncation search techniques, only 13% of the respondents are using Field search.

4.4.8 Use of various e-databases

E-database is an organized collection of data stored in a digital format. Electronic databases are designed to efficiently manage, organize, and retrieve information. There are several free databases while other are subscription base. The present study measures the use of various online databases by faculty

members of NEHU and MZU. Likert scale for frequency is used to measure the frequency.

Table 4.19: Use of Various e-databases

Sl. No	E-Resources	Frequency	NEHU (N=246)	MZU (N= 160)	Total
1	CORE	Never	31 (13%)	12 (8%)	43 (11%)
		Rarely	58 (24%)	23 (14%)	81 (20%)
		Sometimes	46 (19%)	22 (14%)	68 (17%)
		Often	57 (23%)	72 (45%)	129 (32%)
		Always	54 (21%)	31 (19%)	85 (21%)
2	DOAJ	Never	10 (4%)	13 (8%)	23 (6%)
		Rarely	40 (16%)	10 (6%)	50 (12%)
		Sometimes	76 (31%)	51 (32%)	127 (31%)
		Often	71 (29%)	62 (39%)	133 (33%)
		Always	49 (20%)	24 (15%)	73 (18%)
3	Scopus	Never	14 (6%)	25 (16%)	39 (10%)
		Rarely	9 (4%)	7 (4%)	16 (4%)
		Sometimes	75 (30%)	55 (34%)	130 (32%)
		Often	96 (39%)	54 (34%)	150 (37%)
		Always	52 (21%)	19 (12%)	71 (17%)
4	Science Direct	Never	13 (5%)	14 (9%)	27 (7%)
		Rarely	19 (8%)	24 (15%)	43 (11%)
		Sometimes	52 (21%)	53 (33%)	105 (26%)
		Often	77 (31%)	17 (11%)	94 (23%)
		Always	85 (35%)	52 (32%)	137 (34%)
5	DOAR	Never	34 (14%)	23 (14%)	57 (14%)
		Rarely	38 (15%)	27 (17%)	65 (16%)
		Sometimes	68 (28%)	21 (13%)	89 (22%)
		Often	63 (26%)	43 (27%)	106 (26%)
		Always	43 (17%)	46 (29%)	89 (22%)
6	GOI initiatives databases	Never	8 (3%)	9 (6%)	17 (4%)
		Rarely	11 (4%)	13 (8%)	24 (6%)
		Sometimes	50 (20%)	22 (14%)	72 (18%)
		Often	102 (42%)	79 (49%)	181 (45%)
		Always	75 (31%)	37 (23%)	112 (28%)

Source: Primary Data

Analysis of data represented at Table 4.7 throw lights to the following information:

1. **CORE*:*** In the case of NEHU, 24% out of the total 246 respondents rarely use CORE and 23% of them claims to have often use CORE

database. 19% of the respondents sometimes use CORE while 21% of them always use it and only 13% of the respondents never use CORE database.

In MZU almost half of the respondents i.e. 45% often use CORE and 19% of them always use it. Those respondents who rarely use it and sometimes use constitute 14% each of the total 160 respondents and only 8% of the respondents never use CORE.

In the overall cases, 32% out of the total 406 respondents from NEHU and MZU claims that they often use CORE database and 21% of the respondents always use this database, 20% of them rarely use it and 17% of respondents sometimes use CORE while 11% of the respondents never use CORE.

2. **DOAJ:** In NEHU out of the total 246 respondents, 31% of them sometimes use DOAJ and 29% of the respondents often use DOAJ whereas 20% of them always use it and 16% of the respondents rarely use DOAJ, only 4% of the respondents never use DOAJ.

   In the case of MZU, out of the total 160 respondents, 39% of the respondents often use DOAJ database and 32% of the respondents sometimes use this database. 15% of them claims that they always use DOAJ, 8% of the respondents never use DOAJ and only 6% of the respondents rarely use it.

   Out of the total 406 respondents from both NEHU and MZU 33% of the respondents often use DOAJ and 31% of the respondents sometimes use DOAJ while 18% of them always use it and 12% of them rarely use DOAJ whereas only 6% of the respondents never use DOAJ.

3. **Scopus:** The data so retrieved suggested that use of Scopus is very prevalent among the respondents in NEHU. Out of the total 246 respondents from NEHU majority of the respondents i.e. 39% often use Scopus and 30% of them use it sometimes. 21% of the respondents marked that they always use

Scopus database and 6% of them never use it while only 4% of the respondents.

In MZU, out of the total 160 respondents those who utilise Scopus database sometimes and often are both 34% each while 16% of the respondents never use the said database and 12% of the respondents always use Scopus, only 4% of the respondents rarely use Scopus.

It is highlighted that 37% out of the total 406 respondents from NEHU and MZU claimed that they often use Scopus database and 32% of them use it sometimes. 17% of the respondents said that they always use Scopus while 10% of the respondents never use this database and only 4% of the respondents rarely use Scopus database.

4. **Science Direct:** Out of the total 246 respondents from NEHU 35% of them always use Science Direct and 31% of them often use it. 21% of the respondents claims that they use the said database sometimes, 8% of them rarely use it and only 5% of the respondents never use Science Direct online database.

   In MZU, majority of the respondents i.e. 33% sometimes use Science Direct and 32% of them said that they always use this database. 15% of the respondents rarely use the said database while 11% of them often use Science Direct while only 9% of the respondents never use Science Direct. Out of the total respondents 406 from both universities taken for study 34% of the respondents always use Science Direct and 26% of them sometimes use the said database. 23% of the respondents claims that they often use this database and 11% of them rarely use Science Direct while 7% never use Science Direct.

5. **DOAR:** In the case of NEHU majority of the respondents i.e. 28% sometimes use DOAR while 26% of them often use the database. It is identified that 17% of the respondents always use the said database whereas 15% of them rarely use DOAR and 14% of the respondents from NEHU

never use DOAR.

In MZU, out of the total 160 respondents 29% always use DOAR while 27% of the respondents often use this database. 17% of them claimed that they rarely use DOAR database and 14% of the respondents never use it while 13% of the respondents sometimes use DOAR.

Out of the total 406 respondents from both NEHU and MZU 26% of the respondents often use DOAR database while the number of respondents who use the said database sometimes and always are exactly the same figure i.e. 22% whereas 16% of the respondents claimed that they rarely use DOAR while 14% of them never use DOAR.

6. **GOI Initiatives Database:** In NEHU, out of the total 246 respondents 42% of them often use databases created under GOI initiatives and 31% of the respondents claimed that they always used the same databases, 20% of them sometimes use these databases while 4% of the respondents never use it and only 3% of the respondents never use such databases.

   In MZU, out of the total 160 respondents almost half i.e. 49% often use GOI initiative databases and 23% of the respondents always use these databases. 14% of them use such databases sometimes while 8% of the respondents rarely use it and only 6% of the respondents never use such databases initiated by Govt. of India. It is identified that 45% of the total 406 respondents from both universities often use online database initiated by Govt. of India under various schemes and agencies while 28% of the respondents always used the said database. 18% of them used these databases sometimes while 8% of them rarely use it and only 6% of the respondents never use such database under GOI initiatives.

4.4.9 Skills in desktop publishing

There is several desktop publishing software which enables users to create textual or image content. It is very important to have ample skills in order to maximise use of various e-resource. This study highlights the skills of the

respondent in using different desktop publishing software using Liker Scale 5 point of Quality.

Table 4.20: Skill level in using desktop publishing applications

Sl. No	Skill levels	NEHU (N=246)	MZU (N=160)	Total
1	Very Poor	31 (13%)	12 (8%)	43 (11%)
2	Poor	29 (12%)	11 (7%)	40 (10%)
3	Fair	66 (27%)	22 (14%)	88 (22%)
4	Good	78 (32%)	64 (40%)	142 (35%)
5	Excellent	42 (17%)	51 (32%)	93 (23%)
	Total	**246**	**160**	**406**

Source: Primary data

Table 4.20 shows that in NEHU, majority of the respondents i.e. 32% have Good skills in using various desktop publishing tools while 27% of the respondents have Fair skills in using the same. 17% of the respondents from NEHU have excellent skills in using various desktop publishing software while 13% have Very Poor skills and only 12% have Poor skills. In the situation of MZU, similarly like NEHU majority of the respondents from MZU i.e. 40% have Good skills in using desktop publishing software and 32% of the respondents have excellent skills. 14% of the respondents have Fair skills and 8% of the respondents have Very Poor skills and only 7% of them have Poor Skills. Compilation of data from both the universities taken for studies highlight that out of the total 407 respondents from NEHU and MZU 35% have Good Skills in using desktop publishing software and 23% of the respondents have excellent skill in desktop publishing task. 22% of the respondents claimed have Fair skills while 11% of the respondents have Very Poor skills and only 10% have Poor skill. Most of the respondents have average and above skills in desktop publishing in both the university taken for study.

4.4.10 Attainment of computer proficiency certificates.

Computer proficiency certificate taken under the present study includes any level computer proficiency certificates or diploma acquired through formal or non- formal courses

Table 4.21: Acquiring computer proficiency certificates based on gender

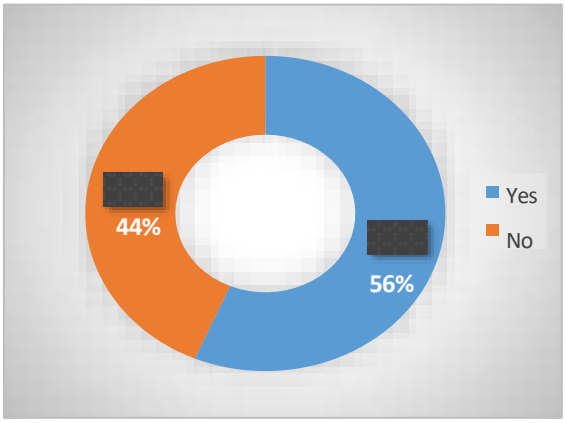
Sl. No.	Response	Male (N=211)	Female (N=195)	Total
1	Yes	133 (66%)	96 (49%)	229 (56%)
2	No	78 (34%)	99 (51%)	177 (44%)
	Total	**211**	**195**	**406**

Source: Primary data

Table 4.21 shows out of the total 211 male respondents 66% of them have attained computer proficiency certificates while 34% of them do not attain computer proficiency certificates.

Out of the total 195 female respondents 51% of them do not attain such computer proficiency certificates while 49% of the respondents do not attain the said certificates.

In the over-all case, out of the total 406 respondents 56% of them have attained computer proficiency certificate while 44% of the have not attain such certificates.



4.11: Acquiring computer proficiency certificates by all respondents

4.5 Programmes facilitated by libraries to enhance ICT skills of faculty members

There are several avenues which can be facilitated by libraries in order to developed ICT skills to its users, organising seminar and workshop. These events contribute to the holistic development of ICT skills, preparing students for the challenges of the rapidly evolving technology landscape. They also offer opportunities for collaboration, networking, and exposure to real-world

applications of ICT in various industries. Initiating library orientation programme are highly eminent among various academic libraries across the globe.

4.5.1 Attending programmes to enhance ICT skills

The present study intends to find out whether the respondents have ever attended any events organised by any other university or agencies to enhance their ICT skills. This programme may include seminar, conference, workshop or symposium.

Table 4.22: Attending events organised to promote ICT Skills

Sl. No.	Response	NEHU (N=246)	MZU (N=160)	Total
1	Yes	172 (70%)	93 (58%)	265 (65%)
2	No	74 (30%)	67 (42%)	141 (35%)
	Total	**246**	**160**	**406**

Source: Primary data

Table 4.22 indicates that in NEHU, More than two-third of the respondents i.e. 70% of them have attended programmes for enhancement of their ICT skills while 30% of the respondents have not attend any programme of this sort.

In MZU, over half of the respondents i.e. 58% have attended programmes for development of their ICT skills while 42% of them have not attend the said programmes.

Out of the total respondents from both the university taken for study 65% of the respondents have attended programmes which is based on development of ICT skills while 35% of the respondents have not attended any such programmes.

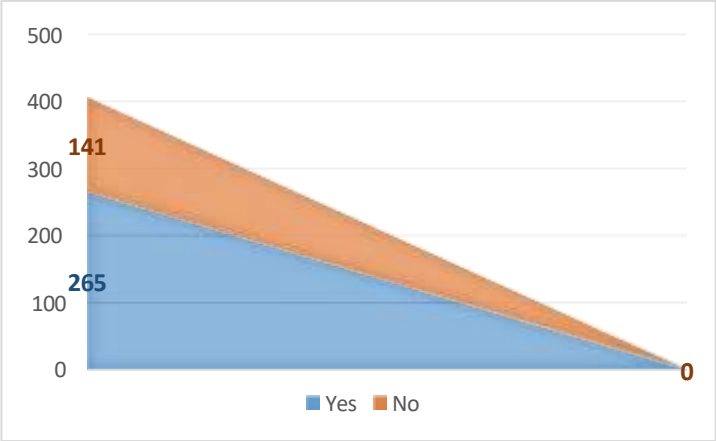


Figure 4.12: Showing attendance of event on ICT skills among respondents

4.5.2 Satisfactory level on ICT skills enhancement programmes.

The present study intended to indicate the satisfactory level of those respondents who have attended such events to develop their ICT skills.

Table 4.23: Designation wise satisfactory level of ICT Skills enhancement programmes

Sl. No.	Satisfactory Level	Professor (N=131)	Associate Professor (N=124)	Assistant Professor (N=151)
1	Not at all satisfied	20 (15%)	7 (6%)	13 (9%)
2	Slightly satisfied	21 (16%)	41 (33%)	26 (17%)
3	Moderately satisfied	38 (29%)	25 (20%)	62 (41%)
4	Very satisfied	19 (14%)	40 (32%)	27 (18)
5	Completely satisfied	33 (25%)	11 (9%)	23 (15)
	Total	**131**	**124**	**151**

Source: Primary Data

Table 4.23 shows that out of the total 131 Professors of both MZU and NEHU majority of them i.e. 29% are moderately satisfied with the events facilitate to enhance their ICT skills, 25% of them are completely satisfied, 16% of them are slightly satisfied, 15% of the respondents are not at all satisfied while 14% of the respondents are very satisfied with the events organised by the library in order to enhance the ICT skills of its users.

In the case of Associate Professors who amounts to 124 respondents, majority of the respondents i.e. 33% are slightly satisfied with the ICT skills

enhancement programmes of the library followed by 32% who claim that they are very satisfied, 20% of the respondents say that they are moderately satisfied and 9% of them claims that they are completely satisfied while 6% of the respondents claims that they are not at all satisfied with the avenues developed by the library to enhanced the ICT skills of its users.

Out of the total 151 Assistant Professors who participated in the present study majority of the respondents i.e. 41% are moderately satisfied with the programme facilitated by the library in order to enhanced the ICT skills of its users, 18% of them are very satisfied, 17% of them are slightly satisfied and 15% of the respondents are completely satisfied while only 9% of the respondents are not at all satisfied with the programmes facilitated by the library to enhanced the ICT skills of the users.

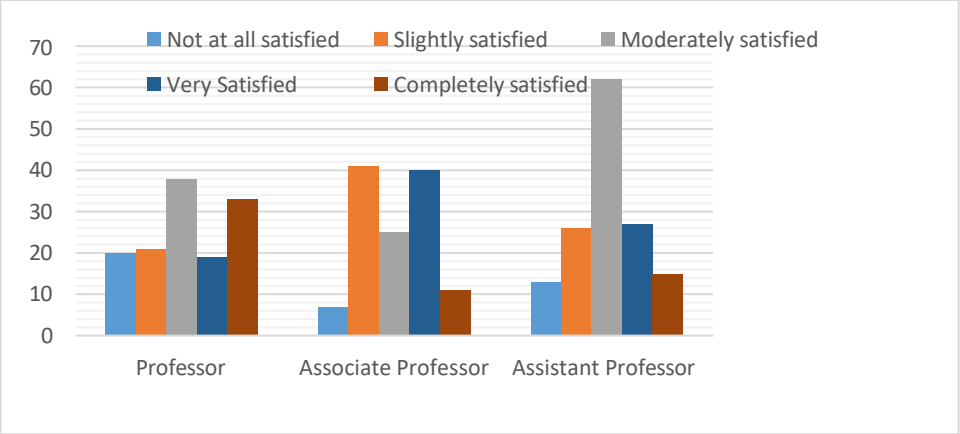


Figure 4.13: Respondents' satisfactory level on ICT skills programme

4.6. Ability to critically evaluate web resources

Critical evaluation of web resources is essential because it ensures that the information we access online is reliable, accurate, and relevant. There is a vast amount of information available online, and not all of it is accurate or reliable. Critical evaluation helps to separate credible sources from misleading or false ones, which can prevent us from making decisions based on inaccurate information. By critically evaluating web resources, we can quickly identify sources that are credible and relevant to our needs, saving us time and effort that might otherwise be wasted on irrelevant or unreliable information. The

information we access online can have a significant impact on our decision-making processes, from personal decisions to professional ones. By ensuring that we are accessing credible and accurate information, we can make informed decisions based on facts rather than opinions or misleading information. Some websites and sources may have a particular agenda or bias, which can affect the accuracy and relevance of the information presented. Critical evaluation helps us identify bias and make sure we are accessing information that is objective and impartial. Critical evaluation of web resources can develop our research skills and become better equipped to find and evaluate information in the future.

In short, the critical evaluation of web resources is crucial for accessing reliable, accurate, and relevant information that can inform our decisions and help us achieve our goals.

Thus, the present study intends to highlight the ability of the faculty members of both the university taken for study so as to find out the impact of web-resources in their career. In order to identify such ability the present study considers critical evaluation of e-resources, criteria used by the respondents for evaluation of web resources, awareness levels on predatory journals and the criteria used by individual to determine predatory journals, capability on using journal finders and use of journal finder as key criteria to measure the ability of the respondents to critically evaluate web based resources.

4.6.1 Evaluation of E-Resources

Information explosion over the internet domain has sprung the necessity for strong ability to critically evaluate e-resources found from the web. Surging amount of predatory publishing has deteriorate the research ethics at various level and this problem requires urgent redressal in order to maintain quality in the intellectual community. Hence, the present sought to highlight the ability of the faculty members of both the university taken for study using various parameters.

Table 4.24: Ability to critically evaluate e-resources found on web

Sl. No	Skill levels	NEHU (N=246)	MZU (N=160)	Total
1	Very Poor	35 (14%)	24 (15%)	59 (15%)
2	Poor	34 (14%)	27 (17%)	61 (15%)
3	Fair	72 (29%)	55 (34%)	127 (31%)
4	Good	84 (34%)	42 (26%)	126 (31%)
5	Excellent	21 (9%)	12 (8%)	33 (8%)
	Total	**246**	**160**	**406**

Source: Primary data

In NEHU, majority of the respondents (34%) have Good skills in critical evaluation of e-resources, 23% have Fair Skills while, 53 (14%) have Very Poor skills and 34 (15%) have Poor skills, 9% of the respondents have Excellent skills.

In MZU, out of the total 246 respondents majority of the respondents (34%) have Fair skills and 26% have Good skills. 17% of them claim to have Poor skills, 15% have Very Poor skills and only 8% have excellent skills.

Analysis of the data at table 2.24 shows that in general faculty members of both the university have sound ability to critically evaluate e-resources found from the web. Out of the total 406 respondents 127 (31%) have Fair ability in critically evaluation of e-resources and 126 (31%) of them claim to have Good skills, while 59 (15%) of them claim to have Very poor skills and 61 (15%) have Poor skills and only 33 (8%) have Excellent skills.

4.6.2 Criteria used to evaluate e-resources

The present study tends to highlight various criteria used by faculty members of both MZU and NEHU in evaluating the reliability of web information. In this regard, the present study does not intend to conform any single factor as the most efficient factor in identifying the authenticity of any information found over the web. However, it is simply put to an effort to identify the most used criteria among several possible criteria.

Table 4.25: Criteria used to evaluate reliability of web information

Sl. No	Criterion used	NEHU (N=246)	MZU (N=160)	Total
1	Links given in the library webpage	40 (16%)	18 (11%)	58 (14%)
2	Further readings suggested by the syllabus	51 (21%)	32 (20%)	83 (21%)
3	Display of the website or webpage of a library	48 (20%)	33 (21%)	81 (20%)
4	Publisher's eminence	60 (24%)	34 (21%)	94 (23%)
5	Author status and citation score	20 (8%)	12 (8%)	32 (8%)
6	Frequency of updating	27 (11%)	31 (19%)	58 (14%)
	Total	**246**	**160**	**406**

Source: Primary data

Analysis of data in table 4.25 shows that in NEHU, 24% of the respondents use Publisher's eminence as the main criteria for deciding the reliability of web information, 21% each of the respondents use further readings suggested by the syllabus as their criteria and 20% of them use display of the website or webpage. 16% of the respondents use Links given in the library webpage to decide the reliability of web information while 11% of them use the frequency of updating information and only 8% of them use author status and citation score as criteria for reliability of web information.

In MZU, 21% each of the respondents use display of the website and Publisher's eminence as the main criteria for deciding the reliability of web information. 20% of them use further reading suggested by the syllabus as their criteria while 19% of them use frequency of updating as their main criteria. 11% of them use Link given in the Library webpage as their main criteria for deciding the reliability of web information while only 8% of them use Author status and citation score as criteria for deciding the reliability of web information.

Table 4.25 also shows that out of the total 406 respondents from both NEHU and MZU 23% of the respondents are using Publishers eminence as the main criteria for identifying the reliability of web information, 21% of them are using further readings suggested by the syllabus as criteria for reliability of

web information, 20% identify the reliability of web information through the display of the website or webpage and 14% each use Links given in the library webpage and Frequency of updating website as their criteria and only 8% of the respondents use Author status and citation score as valid criteria for selecting reliable web information.

4.6.3 Awareness on predatory journals

Surging issues on predatory journals has deteriorated the integrity of the scholastic community in several ways therefore it is very important of the intellectual members to be able to differentiate predatory journals for publications. Awareness of predatory journals is crucial for researchers, academics, and anyone involved in scholarly publishing. Predatory journals exploit the academic publishing system for financial gain, often engaging in unethical practices. This study highlight the awareness level of faculty members of NEHU and MZU on predatory journals.

Table 4.26: Awareness on predatory journals

Sl. No.	**Response**	**NEHU (N=246)**	**MZU (N=160)**	**Total**
1	Yes	234 (95%)	153 (96%)	387 (95%)
2	No	12 (5%)	7 (4%)	19 (5%)
	Total	**246**	**160**	**406**

Source: Primary data

The above table highlight that in NEHU, 95% of them are aware about the existence of predatory journals while only 5% of them does not have awareness on predatory journals.

In MZU, 96% of the respondents are aware about predatory journals and only 4% of them do not have awareness on predatory journals.

In both the university taken for study is can be seen that out of the total 406 respondents 95% of the respondents are aware about predatory journals while only 5% of the respondents are not aware of predatory journals.

4.6.4 Criteria used to define predatory journals

There are several criteria which can be used to identify the quality of journals such as quality of content, looks of the journal/journal website, publisher's credibility and members of the editorial team. The present study try to highlight the most used criteria for deciding predatory journals.

Table 4.27: Criteria used to define predatory journals

Sl. No	Criterion used	NEHU (N=234)	MZU (N=153)	Total
1	Quality of content	81 (35%)	30 (20%)	111 (29%)
2	Unrealistic looks of the journal/journal website	74 (32%)	32 (21%)	106 (27%)
3	Publishers Credibility	55 (24%)	51 (33%)	106 (27%)
4	Editorial team	24 (10%)	40 (26%)	64 (17%)
	Total	**234**	**153**	**387**

Source: Primary data

In NEHU, out of the total 246 respondents more than one-third i.e. 35% of the respondents use the quality of content of the journal to differentiate predatory journals while, 32% of the respondents use unrealistic looks of the journal/journal website as criteria for identifying predatory journals, 24% of the respondents used the publisher credibility as main criteria for understanding predatory journals and only 10% of the respondents use the members of the editorial team for selecting predatory journals.

In the case of MZU, out of the total 160 respondents more than one-third of the respondents i.e. 33% use publisher's credibility as the main benchmarks for deciding predatory journals while 26% of them use member of the editorial team to identify predatory journals. 21% of the identify predatory journals through its unrealistic look and 20% of the respondents use the quality of the content to categorise predatory journals

Table 4.27 shows that in the complete case out of the total 406 respondents from both NEHU and MZU, majority of them i.e. 29% use the quality of the content to identify predatory journals while the unrealistic looks of the journal/journal website and publisher's credibility are used as criteria by

27% each and 17% of the respondents used member of the editorial team as main criteria for deciding predatory journals.

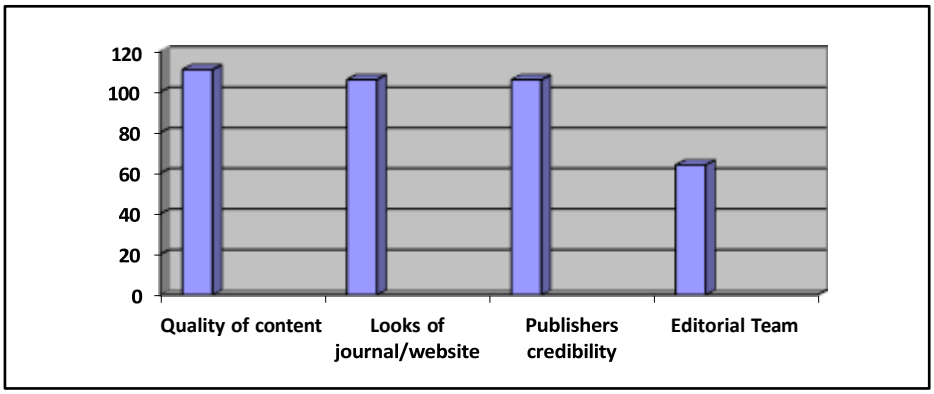


Figure 4.15: Criteria used to define predatory journals by respondents

4.6.5 Awareness on using journal finders

There are several journal finders over the internet for identifying authentic journals as well suitable journals for specific topic of research. However the present study explores the awareness level of the respondents in using these journal finders.

Table 4.28: Gender based awareness on using journal finders

Sl. No.	**Response**	**Male (N=211)**	**Female (N=195)**	**Total**
1	Yes	180 (85%)	152 (78%)	332 (81%)
2	No	31 (5%)	43 (22%)	74 (19%)
	Total	**211**	**195**	**406**

Source: Primary data

Table 4.28 shows that in out of the total 211 male respondents 85% of them have awareness on using journal finders while only 5% of them do not have the same awareness. In the case of female respondents which account to a total of 195, 78% of them are aware of using journal finders while 22% of the do not have the said awareness.

In the over-all scenario, out of the total 406 respondents 81% of them have awareness on using journal finders while 19% of them do not have

awareness on using such journal finders

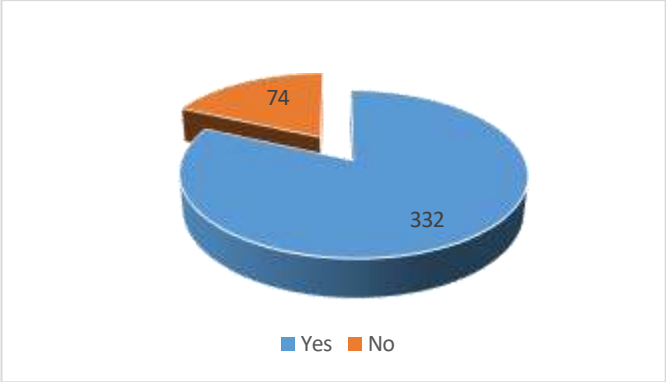


Figure 4.16: Respondents' awareness on using journal finders

4.6.6 Use of journal finders

There are several Journal finders over the internet and the present study intend to highlight the most frequently used journal finders by faculty members of NEHU and MZU.

Table 4.29: frequently used journal finder

Sl. No.	Name of journal finder	NEHU (N=180)	MZU (N=103)	Total
1	JANE	38 (21%)	28 (27%)	66 (23%)
2	Elsevier Journal Finder	51 (28%)	35 (34%)	86 (30%)
3	Springer Journal Finder	48 (27%)	23 (22%)	71 (25%)
4	Romeo/sherpa	43 (24%)	17 (17%)	60 (21%)
	Total	**180**	**103**	**283**

Source: Primary data

Table 4.29 shows that in NEHU, out of the total 180 respondents who use journal finders majority of them i.e. 28% use Elsevier Journal Finder, 27% of them Springer Journal Finder, 24% of them use Romeo/Sherpa and 21% of them use JANE.

In MZU, out of the total 103 respondents 34% of them use Elsevier Journal Finder, 27% of them use JANE, 22% use Springer Journal Finder and 17% of them use Romeo/Sherpa.

Table 4.29 shows that out of the total 283 respondents from both the universities who claim use journal finder majority of them i.e. 30% use Elsevier Journal Finder, 25% of them use Springer Journal Finder, 23% of them JANE and 21% of them use Romeo/Sherpa.

4.7 Use of Library e-resources to excel in teaching

Teachers can use e-resources in many ways to enhance their teaching and provide engaging and effective learning experiences for their students. E-resources can be used to research topics they are teaching or to find new teaching resources and find lesson plans, activities, and materials that they can use to plan their lessons. E- resources provide instructional materials such as videos, audio recordings, and interactive simulations to engage students in learning and promote creative way of teaching learning process. Teachers can use e-resources to facilitate collaborative learning by providing online tools for communication and collaboration such as discussion forums, wikis, and online whiteboards; it can also be used for assessment purposes, such as online quizzes, tests, and interactive activities that provide instant feedback to students.

Overall, e-resources offer a wealth of opportunities for teachers to enhance their teaching and engage students in the learning process. By incorporating e- resources into their teaching practices, teachers can create dynamic and interactive learning environments that meet the needs of today's digital learners.

4.7.1 Satisfactory level on library collection for teaching preparation.

The present study survey the level of contentment and fulfilment that individuals experience when utilizing library services and resources. User satisfaction is a crucial aspect for libraries as it reflects the effectiveness of their services in meeting the needs and expectations of their patrons. There may be different category of users in a library and the purpose for which they approach the library may be different. The present study intends to highlight the satisfactory level of the respondents in regards to the library collection.

Table 4.30: Satisfactory level on library collection for teaching preparation

Sl. No.	Satisfactory Level	NEHU (N=246)	MZU (N=160)	Total
1	Not at all satisfied	17 (7%)	23 (14%)	40 (10%)
2	Slightly satisfied	18 (7%)	17 (11%)	35 (9%)
3	Moderately satisfied	89 (36%)	36 (22%)	125 (31%)
4	Very satisfied	105 (42%)	48 (30%)	153 (38%)
5	Completely satisfied	17 (7%)	36 (23%)	53 (13%)
	Total	**246**	**160**	**406**

Source: Primary data

Table 4.30 shows that in NEHU out of the total 246 respondents 42% of them are Very Satisfied with the library collections, 26% of them are Moderately Satisfied and those respondents who are Not at all Satisfied, Slightly Satisfied and Moderately Satisfied constitute 7% each of the total respondents.

In MZU, out of the total 160 respondents' majority of the respondents i.e. 30% are Very Satisfied while 23% of them are Completely Satisfied and 22% of them are moderately satisfied. 14% of the respondents are Not at all satisfied and 11% of them are Slightly Satisfied.

Out of the total 406 respondents from both the universities 38% of the respondents are very satisfied with the library, 31% of them are moderately satisfied and 13% of them are completely satisfied. 10% of them are not at all satisfied and only 9% of the respondents are slightly satisfied.

Figure 4.17: Satisfactory level on library collection to support teaching

4.7.2 Satisfactory level on online service provided by the library

Library user satisfaction with electronic resources is a critical aspect of assessing the effectiveness of a library's digital offerings. The satisfaction level with online services provided by a library can be influenced by various factors. By paying attention to these factors, libraries can enhance the satisfaction levels of users with their online services, contributing to a positive and efficient research and learning experience. Regular assessments and updates based on user feedback are also essential for continuous improvement. The central libraries if both NEHU and MZU subscribed to various e-resources through different platforms and remote access facility is also provided for their users. This study mean to categorise the satisfactory level of the respondents in regards to the online services provided by central library of both the universities.

Table 4.31: Satisfactory level on online service provided by the library

Sl. No.	Satisfactory Level	NEHU (N=246)	MZU (N=160)	Total
1	Not at all satisfied	16 (7%)	19 (12%)	35 (9%)
2	Slightly satisfied	37 (15%)	26 (16%)	63 (15%)
3	Moderately satisfied	92 (37%)	42 (26%)	134 (33%)
4	Very satisfied	80 (33%)	54 (34%)	134 (33%)
5	Completely satisfied	21 (9%)	19 (12%)	40 (10%)
	Total	**246**	**160**	**406**

Source: Primary data

Analysis of the above data in table 4.31 it is found that in NEHU out of the total 246 respondents 37% of them are moderately satisfied, 33% of them are very satisfied while 15% of them are slightly satisfied, 9% of the respondents are completely satisfied and only 7% of them are not at all satisfied.

In MZU, out of the total 160 respondents' majority of the respondents i.e. 34% are Very Satisfied, 26% of them are moderately satisfied and 16% of

them are Slightly Satisfied. The respondents who are Not at all satisfied and completely satisfied are 12% each out of the total respondents.

In over all out of the total 406 respondents of both NEHU and MZU the respondents who are moderately satisfied and very satisfied constitute 33% each of the total respondents, 15% of them are slightly satisfied and 10% of them are completely satisfied while 9% of them are not at all satisfied.

4.8 Availability of e-resources in NEHU and MZU

Library of both NEHU and MZU are known to be well equipped with varied knowledge resources. The present study intend to highlight the vastness of e-resources collection in both central library of NEHU and MZU through structured questionnaire designed for the specific purpose.

4.8.1 Status of e-resources in NEHU and MZU

The present study intends to highlight the collection status of various forms of e-resources in both universities under study.

Table 4.32: Availability of e-resources in NEHU and MZU

Sl. No	**E-Resource**	**Availability status in NEHU**		**Availability status in MZU**	
		Yes	No	Yes	No
1	E-Books	✓	-	✓	-
2	E-Journals	✓	-	✓	-
3	E-Thesis/Dissertations	✓	-	✓	-
4	Full text e-database	✓	-	✓	-
5	Bibliographic e-database	✓	-	✓	-

Source: Primary Data

Table 4.32 shows that both the universities have collection of e-resources such as, E-Books, E-Journals, E-Thesis/Dissertations, Full Text e-database and Bibliographic e-database.

4.8.2 Availability of remote access

Provision for remote access of library resources is an important factor for facilitating effective information dissemination in the library. It multiplies the use of library resources and help in saving the time of the user as framed in the Five Laws of Library Science. There are many e-resources which is bound for only intranet accessibility but the present study intend to highlight the status of remote access facilities in both the Universities.

Table 4.33: Provision of remote access

Sl. No	Response	NEHU	MZU
1	Yes	✓	✓
2	No	-	-

Source: Primary Data

Analysis of the above data shows that provision of remote access of library e- resource collection is given in both the universities.

4.8.3 Availability of separate library website

The present study highlights the availability of separate website for library of both universities. However analysis of the data at table 4.34 shows that both NEHU and MZU library does not have separate library website, but both universities have separate webpage within the university website and utilise it effectively.

Table 4.34: Separate library website

Sl. No	Response	NEHU	MZU
1	Yes	-	-
2	No	✓	✓

Source: Primary Data

4.8.4 Availability of OPAC and Web-OPAC facilities

OPAC is a digitized bibliographic record of library collection which is accessible by the user to search their desired documents. The present study intends to highlight the availability of both OPAC and Web-OPAC at the central library of both NEHU and MZU.

Table 4.35: Availability of OPAC/Web-OPAC

Sl. No	Facilities	NEHU		MZU	
		Yes	No	Yes	No
1	OPAC	✓	-	✓	-
2	WebOPAC	✓	-	✓	-

Source: Primary Data

Data available at table 4.34 shows that both NEHU and MZU provide OPAC as well as WEbOPAC facilities to all its users.

4.8.5 Subscription of e-resource

E-resources have become increasingly prevalent in modern libraries, complementing or even replacing traditional print materials. E-resources cover a wide range of formats and subjects, providing users with diverse and easily accessible information. Subscribing to electronic resources involves acquiring access to digital materials, databases, or services for a specific period through a formal agreement. Subscribing to electronic resources involves acquiring access to digital materials, databases, or services for a specific period through a formal agreement. The present study takes into account the accessibility of various online database with high scholarly content at both universities.

4.36: Accessibility of e-resources

Sl. No	E-Resources	Subscription NEHU		Subscription MZU	
		Yes	No	Yes	No
1	Jstor	✓	-	✓	-
2	Science Direct	✓	-	✓	-
3	Springer Link	✓	-	✓	-
4	Wiley Blackwell	✓	-	✓	-
5	Scopus	✓	-	✓	-
6	Taylor and Francis	✓	-	✓	-
7	Web of Science	✓	-	✓	-
8	IEEE Databases	✓	-	✓	-
9	Indiastats	✓	-	-	✓
10	GOI initiatives	✓	-	✓	-

Source: Primary Data

Table 4.35 shows that central libraries of both universities are well

equipped with e-resources, they are subscribed to most of the renowned online database high good scholarly content at both national and international level.

4.9 Events facilitated by NEHU and MZU to improve ICT skills of faculty members

Initiating events to improve ICT skills of faculty members is crucial as the fast- paced developments in technology, integrating ICT skills in teaching have become a necessity. Conducting workshops and events that help faculty members acquire and upgrade their ICT skills can significantly enhance their teaching capabilities. This can lead to more engaging and interactive classroom sessions, which can, in turn, result in better learning outcomes for students. ICT skills are essential for conducting research in many fields. Faculty members, who have ICT skills can use digital tools to collect, analyse and present data. This can help them to conduct research more efficiently and effectively. The fast-changing landscape of technology requires faculty members to keep up with the latest trends and tools to stay competitive. Conducting events to improve ICT skills can encourage innovation and creativity, leading to the development of new teaching methods, research projects, and collaborations.

In conclusion, conducting events to improve ICT skills of faculty members is essential for enhancing teaching, research capabilities, encouraging innovation, supporting career development, and meeting the expectations of stakeholders.

4.9.1 Organising Library Orientation programme

Library Orientation Programme is an important event to make fresh users of the library more acquainted to the complex mechanism of the library system. The present study intend to highlight the organisation of Library Orientation programme at both NEHU and MZU and from the data available at table 4.36 it is observed that both universities organised Library Orientation programme at regular interval.

Table 4.37: Organising Library Orientation

Sl. No	Response	NEHU	MZU
1	Yes	✓	✓
2	No	-	-

Source: Primary Data

4.9.2 Events to enhance ICT skills of Faculty members

Organizing events to enhance the ICT (Information and Communication Technology) skills of faculty members is crucial for ensuring they stay current with technological advancements. It is ideal that the each university must organise events to build strong ICT skills among its fraternity. These events should be tailored to the specific needs and interests of faculty members, ensuring they have the skills and knowledge necessary to integrate technology effectively into their teaching, research and professional development. The present study tries to highlight the regularity of organising such events at both universities taken for study.

Table 4.38: Frequency of organising ICT Skills Development Programme

Sl. No	**Frequency**	**NEHU**	**MZU**
1	Never	-	-
2	Rarely	-	-
3	Sometimes	-	-
4	Often	✓	✓
5	Always	-	-

Source: Primary Data

Table 4.37 shows that in both NEHU and MZU the benchmark regularity of organising ICT skills development programme is often when measured in terms of Likert 5 point Scale for frequency.

4.9.3 Characteristics of events organised

There are several characteristics under which any events for ICT skill development can be organised. The present study intends to identify the nature

on how such events are organised by both the universities taken for study.

Table 4.39: Characteristics of events organised

Sl. No	Characteristics	NEHU	MZU
1	Seminar/Conference with resource person	✓	✓
2	Seminar/Conference with paper presentation	✓	✓
3	Hands on workshop	✓	✓
4	Symposium with group discussions	✓	✓

Source: Primary Data

Table 4.38 shows that both NEHU and MZU have organised events to enhance ICT skills of faculty members in various characteristics such as, Seminar/Conference with invited resource person, Seminar/Conference with paper presentation from the attendants, Hands on workshop with invited resource person, Symposium with group discussions.

4.10 Findings of the study

Findings of the present study are drawn in firm accordance with the objective framed for the study. This study adopted a total of 6 objectives to present clear understanding of underlying concept of the research.

4.10.1 Findings based on Objective No. 1

The first objective of the study is to, 'Identify the status of e- resources and its allied equipment and infrastructure available in central library of both universities.' Analysis of the data collected resulted in the following findings:

1. Central Library of both NEHU and MZU are subscribed to various types of e- resources, in a broad category e-resources such as E-Books, E-Journals, E- Thesis & Dissertations, Full text E-Database and Bibliographic E-Database are all attained by the central library of both NEHU and MZU
2. Remote access facilities are provided in the central library of both NEHU and MZU. MZU provides remote access to all its users using KNIMBUS software while NEHU provides the same using RemoteXs.
3. Both University libraries do not have a separate website; however

separate webpage is maintained actively in the primary university website of both NEHU and MZU. These webpages contain several important information regarding the institutes as well as links for several open access resources to more efficient information dissemination.

4. The present study investigate if the libraries of NEHU and MZU are subscribed to some of the most renowned e-resources platform such as JSTOR, Science Direct, Springer Link, Wiley Blackwell, Scopus, Taylor & Francis, Web of Science, IEEE Database, Indiastats and other e-resource database created under Govt. of India initiatives and it is found that central library of both NEHU and MZU are subscribed all these e-resource platform.

4.10.2 Findings and Conclusion based on Objective No. 2

The second objective of the study is to, "Identify the frequency and purpose of using e-resources by faculty members," and through thorough analysis of the acquired data it is found that:

1. Majority of the faculty members from both MZU and NEHU spend ample time using a computer on daily basis. The present study shows that frequency of computer usage is highest among Associate Professors as 39% of them use a computer for over 5 hours daily. However frequency of daily computer usage is high among all respondents as majority of the Professors (34%) use a computer for 2-4 hours daily, majority of the Associate Professors (39%) use it for over 5 hours daily and majority of the Assistant Professors (45%) use a computer for 2-4 hours daily. Use of computer among faculty members of both NEHU and MZU tend to be late as out of the total 406 respondents majority of the respondents i.e. 48% tends to use computer only after following a professional career which is almost half of the total respondents.

2. Usage level of various types of e-resources by faculty members of both NEHU and MZU is unevenly distributed. The present study shows that there are some e-resources that are prevalently used while others are scarcely utilized. Out of the total 406 respondents majority of them i.e. 39% claimed that they often use e-books while only 6% of the total respondents never use e-books. The use of e-books tends to be prevalent among faculty members of NEHU and MZU as more than two-thirds of the respondents claim that they use e-books and almost half of the respondents settled on the higher level of Likert Scale used to measure the frequency of usage.

3. Of all the various types of e-resources, e-journal tends to be the most widely used digital knowledge resource as the majority of the respondents i.e. 40% claim that they always use e-journal on a regular basis while only 5% of the respondents never use e-journals.

4. Among all the given e-resources CD ROM are least used as 50% of the total 406 respondents claim that they never use CD ROM sources and there are no respondents claiming that they always use CD ROM sources.

5. Usage level of online database is also very high among faculty members of NEHU and MZU as majority of respondents claim that they use online database but the frequency of usage tends to differ as the highest number of respondents

   i.e. 34% claim that they sometimes use online database and 30% of them claims that they often use it however the margin between these two parameters remain significantly low.

6. Use of audio sources tend to show ominous trend as most of the respondents

   i.e. 30% of the total 406 claim that they use audio sources only sometimes. Majority of the respondents prefer the lower level of Likert Scale use of the present measurement.

7. The use of video sources shows a promising tendency as more than two third of the respondents prefer the higher score in the provided Likert Scale, these may be reflected to the growth of information in the online video portal such as YouTube.

8. As the current research is undertaken among teachers of higher education the purpose of using e-resource tend to align with the nature of service of the respondents. It is found that use of e-resources for preparation of classroom teaching is highest among Professors and Associate Professor while majority of the Assistant Professors use e-resources for the purpose of research publications. It is also found that majority of the respondents prefer to use e- resources for its remote access ability.

9. Among various devices available for accessing e-resources the respondents of all age group highly prefer laptop.

10. Use of e-database is a significant element of the intellectual community in the digital era among various e-databases JSTOR is most widely used database by faculty members of NEHU and MZU while Wiley online library remain the least used database.

4.10.3 Findings based on Objective No. 3

The third objective of the study is to, "Ascertain the level of skills and competency of faculty members of both the universities in accessing e-resources." In depth analysis of the acquired data leads to the following findings:

1. The present study revealed that majority of respondents are good in browsing through the web which is the second highest score in the scale. However, it is found most of the Professors i.e. 35% have good ability in browsing through the web while only 9% of them claim that they have very poor skills. Among the Associate Professors who take part in the present study most of them i.e. 36% indicate that they have good skill level similarly among the Assistant Professors majority of

tem i.e. 35% claimed that they have good skills in browsing through the web. In the overall scenario more than one-third of the respondents indicates that they have fair and above, till excellent skills in browsing through the web for which it can be said that faculty members of both NEHU and MZU are profoundly capable of browsing through the web. It is also found that Google Chrome is the most frequently used web browser among faculty member of NEHU and MZU.

2. Familiarity with different web search engine is very important as it possess different functionality. The present study reveals that google.com is the most familiar search engine among the faculty member of NEHU and MZU as 93% of them are highly familiar and only 1% of the respondents have low familiarity. The present survey also reveals that 62% of the respondents switch to other search engines depending on the nature of their search.
3. In the present study it is found that among male respondents 81% of them are using OPAC facilities while among the female respondents 74% of them are using the same. In the overall case 77% of them are using OPAC facilities which are positive sign that majority of the respondents are aware and use computerised information search and retrieval system. The OPAC provide several search value among which 50% of the respondents use the title value which represent the simplest form of search provision in the OPAC and it can be drawn advanced search strategy of OPAC is not highly used among the respondents. As long as information seeking in the web domain is concern majority of the respondents (45%) are using simple keyword search.
4. An important component of ICT skills includes having the ability to locate accurate information. The present study reveals that Science Direct is the most widely used database of scholarly literature as 34% of the respondents always use the database and 28% of the respondents are using other databases provided under the govt. of India initiatives.

5. It is found that most of the respondents are having decent skills in desktop publishing as 35% of the total 406 respondents have Good skills and 23% have Excellent skills in terms of Likert Scale it is revealed that more than half of the respondents have high rating in the scale. It is also found that majority of the male respondents i.e. 66% attain computer proficiency certificates while majority i.e. 51% of the female respondents do not have the same certificates.

   In the overall case the percentage of respondents (56%) with computer proficiency certificates is higher than compared to those who do not attain the same i.e. 44%.

4.10.4 Findings based on Objective No. 4

The fourth objective of the study is to, "To identify programmes or avenues facilitated by the university to promote ICT skills and competencies of faculty members," and it is found that:

1. On the basis of Likert Scale both the universities often organises conference, seminar and workshop to inculcate ICT skills among the faculty members.

2. The study indicates that most of the respondents i.e. 65% have attended such events organised by their university and the satisfactory level of the respondents for the said events is rather low.

4.10.5 Findings based on Objective No. 5

The fifth objective of the study is to, "Assess the ability of the faculty members of both the universities to critically evaluate various e-resources," and it is found that:

1. Those who find their evaluation to be fair and good is 31% each while only 8% find their skill excellent. However, it is found that majority of the respondents benchmark their skills toward the higher ratings of the scale. Majority of the respondents regard publishers' eminence as the best criteria for accepting the relevance of the information.

2. A vast majority of the respondents i.e. 95% of them are aware of predatory journals and 29% of them used the quality of literature content as criteria for indicating predatory journals. In order to tackle the menace of predatory publishing 85% of the male respondents are aware about using journal while 78% of the female respondents are aware of the same facility. Further, Elsevier journal finder remains the most widely used journal finder as 30% of the respondents are using it.

4.10.6 Findings based on Objective No. 6

The sixth objective of the study is to, "Identify the level of usage of different library resources to excel in teaching and research." Based on the analysis of data obtained it was found that:

1. The satisfactory level of faculty members in NEHU and MZU in using the available library resources regardless of its type is high but not to the top notch as majority of the respondents i.e. 38% claimed to be very satisfied with it.
2. The satisfactory level of the faculty members in NEHU and MZU in using the e-resources for teaching and research is rather high as the respondents who claim they are moderately satisfied and very satisfied are both 33% each.

4.11 Conclusion

The above data are collected through structured questionnaire in view of the objective of the present study. It is intended to find out the use of computers, use of e- resources, level of skills and competencies in using e-resources and other aspects of digital literacy. Likert scale was used when necessary to measure the frequency and level of awareness of various concepts. The analysis is qualitative in nature and the findings are presented in a separate chapter.

5.1 Conclusion

The present study measure the level Information and Communication Technology (ICT) skills and competencies of faculty members of NEHU and MZU with special reference to using e-resources. There are several sets of skills that should be attained for proper and optimise use of e-resources and identifying the incorporation of these skills using various parameters is the main aim of the study. The conclusion has been divided into following sections as raised in the form of the objective of the study

1. Availability of e-resources in NEHU and MZU

Central Library of both NEHU and MZU are well equipped with e-resources. They are both subscribed to various database of e-journals, e-books and other online databases of scholarly content.

a) Frequency and purpose of using e-resources

Faculty members of NEHU and MZU are acquainted to the use of computer rather late in their professional life as most of them started using computer only after following their professional career but interestingly their daily frequency of using computer is highly regular as most of them use computer for above 5 hours every day. Among the various types of e-resources e- journals remain the most highly used e-resources. The chief purpose of using e-resource among the respondents is to prepare themselves for classroom teaching and they prefer to use e-resources due to its remote accessibility.

b) Skill and competency level of faculty members of NEHU and MZU Most faculty members of NEHU and MZU have good skills in browsing through the web which is an important component of ICT skills and competencies. They are also highly aware of one of the most prominent browser and search engine in the web domain namely, google chrome and google respectively. More than half of the respondents are aware of changing their search

engine based on the nature of their search which reflects positive impact on their skill level. Most of the respondents are using WebOPAC facilities provided by the library which shows that they are aware of the convenient way of retrieving and location information but they mostly used simple title search method.

c) Programme to develop ICT skills of faculty members

Both the universities taken for study take good measure in facilitating events such as seminar, workshop, etc. with the cause to promoting ICT skills of its faculty members meanwhile, most of the respondents claim that they are moderately satisfied to the outcome of such events.

d) Critical evaluation of e-resources

Most of the faculty members have good ability in critical evaluation of e- resources and publisher's eminence is the most used criteria for determining the quality of information sources found over the web. Most of the respondents are well aware of predatory journals and quality of content in the journals is mostly used as criteria for identifying predatory journals. Use of journal finder is interestingly prominent among the faculty members of both MZU and NEHU as Elsevier Journal Finder remain the most used journal finder.

e) Use of library e-resources to excel in teaching

The central library of both NEHU and MZU provide ample collection of information sources for the faculty members to excel in teaching it can be concluded that most of the faculty members of NEHU and MZU are very satisfied in regards to the library support for their teaching-learning process.

5.2 Suggestions:

During the research work many areas have been observed for the improvement of ICT skills of faculty members at NEHU and MZU. Following are some suggestions:

1. More hands on workshop should be organised for development of ICT skills.
2. IPR and copyright issues have become an integral part of the ICT based knowledge development and Universities should organise more events to impart knowledge on these issues.
3. Libraries of both Universities should make its users more aware to its ICT based services.
4. All academic departments as well as the university in general should make imparting ICT skills it's among its priorities.
5. Library of both NEHU and MZU should make more collaboration in developing e-resources, its uses and its users.

5.3 Scope for Further Research:

The following areas are suggested for future research on the topic.

1. The future research can investigate the ICT skills of learners at college and school levers as well as educators in the mentioned level.
2. Future research can be conducted on the contribution of various faculty members in development of various open education resources e.g. Video lecture, tutorials, etc.
3. Future research can be conducted on the perception of policy makers on the development of ICT skills among the educators within its jurisdiction

Appendix I

QUESTIONNAIRE

Please tick ☑ in the most appropriate box provided for.

A. General information of the respondent

1. Name of University: ……

2. Name of the Department: …….

3. Designation of the Respondent: □Asst. Professor
□Associate Professor
□Professor

4. Gender

Male ☐
Female ☐
Transgender ☐

5. Age group: □Below 35years
□Between 36-45 years
□46- 55 years
□Above 56 years

B. Frequency and purpose of using E-Resource

1. When do you start using Electronic Resource?
□ High School □ Higher Secondary School
□ College □ University
□ After following professional career

2. How frequently do you use Electronic Resource?
□Always □Often □Sometimes
□Rarely □Never

3. Please indicate how frequently you use the following electronic resources

Sl. No	Name of E-Resource	Never	Rarely	Sometimes	Often	Always
1	E-Books					
2	E-journals					
3	CD- ROM Sources					
4	Databases					

5	Audio Sources					
6	Video Sources					

4. What is your purpose for using Electronic Resource?

□To prepare for teaching □ to update knowledge

□To become lifelong learners □ to write research papers

5. Which online journal database do you use most frequently?

□JSTOR □Elsevier □Springer

□Wiley □Blackwell

6. What is your main reason for using Electronic Resource?

□Speedy Access □Remote Access

□ Updated Information □Timeless Access

C. Skills and Competencies in using E-Resource

1. What device do you mostly use to access Electronic Resources?

□Laptop Computer □Desktop Computer

□Mobil phone □Tablet

2. How many hours per day do you spend using a computer?

□Below 2 hours □2-4 hours

□Over 5 hours □Undecided

3. Do you use internet?

□Yes □No

If yes, please rate your level of capability in browsing through web

□Very poor □Poor □Fair

□Good □Excellent

4. Which of the following browser do you mostly used for browsing through web

□Google Chrome □Firefox

□Internet Explorer □Microsoft Edge

□Other, please specify

5. Which of the following search engine do you mainly use?

□Google.com □MSN.com(Bing)

□Alexa.com □Yahoo.com

6. Have you ever switched your search engine based on the nature of your search?

□Yes □No

7. Do you use the OPAC facilities provided by the library?

□Yes □No

8. If yes, which search value in the OPAC do you use most frequently

□Author □Title □Keywords
□Publisher □ISBN/ISBN

9. How do you search techniques do you use for searching information over the web

□Simple Keyword □Boolean Operators (AND, OR, NOT)
□Truncation □Field Search (title, author, URL, etc)

10. Please rate your skill level in using various desktop publishing tools (eg. MS Words, MS Excel, MS PowerPoint, etc.)

□Very Poor □Poor □Fair
□Good □Excellent

11. Do you have any computer proficiency in computer formal education

□Yes □No

12. Have you ever attended programmes organised by the institution to promote ICT skills and competencies

□Yes □No

If yes, do you think it is satisfactory in developing your professional career?

□Yes □No

D. Skills to critically evaluate e-resources

1. Please rate your ability to critically evaluate e-resources found on the web

□Very Poor □Poor □Fair
□Good □Excellent

2. How do you evaluate the reliability and the authenticity of web information?

□Sources recommended by faculty and Librarian
□Institution reputation
□Author status and affiliation
□Institution publisher's credibility

□Hyperlink link given in a Library/Institutional sites
□Frequency of updating (periodically updated sites)

3. Are you aware of predatory journals?
□Yes □No

4. What criteria do you use to define a predatory journal?
□Quality of Content
□Unrealistic look of the journals and journal website
□Publisher □Editorial team

5. Are you aware of using journal finders to find authenticate journals?
□Yes □No

If yes, which journal finder do you use most frequently
□JANE □Elsevier Journal Finder □Springer
□Journal Suggester □Emerald □Others

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ABSTRACT

ON

INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) SKILLS AND COMPETENCIES AMONG FACULTY MEMBERS OF MIZORAM UNIVERSITY AND NORTH EASTERN HILL UNIVERSITY IN USING E-RESOURCES: A STUDY

An Abstract Submitted In Partial Fulfilment of the Requirements for the Degree of Doctor of Philosophy

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SCHOOL OF ECONOMICS, MANAGEMENT AND INFORMATION SCIENCE

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Introduction:

Information has become the backbone of modern society. Societies which acknowledge the importance of information experiences massive leap in their path to development, but those which does not realized the importance of information are lagging. Information has gained priorities in the global context which ultimately leads to increase of information at an overwhelming pace and the vis-a-vis growing information stresses for better dissemination and more efficient information service and management.

Libraries are the gateway to information through its various services and activities it delivers information to its users (IFLA, 1994). Regardless of their type libraries are becoming more important year by year. National libraries are important to uphold the knowledge integrity of a nation, they are vital centre for preservation of both tangible and intangible heritage of a country, there are several texts that exist in the most primitive form such as, inscriptions in clay tablets, writings on leaves and tree barks, and it is the national libraries which initiate primary responsibilities to preserve these valuably old writings and further digitized them. Public libraries are with its inclusive service opened wide door for learners to quench their thirst for information. Public libraries also provide space for continuing education and lifelong learning (Haggstorm 2004). Academic libraries gratify the scholastic impulse of modern society; it enhances research programs and leads the path of mankind's venture in the vast universe of knowledge. The prime objective of libraries at any level is to facilitate the information need of its users.

Jamil (2013) stated that, “Libraries are one of the important resources, if not the most important, in securing maximum from a well-designed academic program”. Library resources are pragmatic in facilitating the users for academic development. It provides a viable platform for enriching knowledge to the students in general and teachers in particular. Libraries have served both students and teachers by collecting, storing and disseminating vital information through resources like books, journals, maps, micro-films, microfiche, Audio-Visual recordings etc. These resources are available to assist the students in their academic career and the teachers in improving their professional skill. Libraries offer several services to fulfil the information need of its users.

Modern technology introduced many changes in library resources and services. Libraries no longer account to traditional resources but it acquired such resources which are acquainted with modern technology. The service provided by libraries is also changing in many aspects and ICT is the driving force. In order to cope with these changes the user must possess skills which will enable them to retrieve information of their choice from the complex mechanism of the library.

Mizoram University and North-Eastern Hills University: A Brief Profile

North Eastern Hill University (NEHU) and Mizoram University (MZU) are two prominent universities located in the north eastern region of India. While they share the common goal of providing quality education and fostering research, they have distinct histories, locations, and areas of expertise. NEHU and MZU are Central Universities in the north eastern region of India. While they share common goals related to education,

research, and community engagement, they each have a unique focus and areas of expertise. NEHU, with multiple campuses, is known for its interdisciplinary research and a broader regional reach, while Mizoram University plays a significant role in preserving and promoting the culture and languages of Mizoram, where it is based.

Table-1.1: Faculty position of MZU & NEHU

Sl. No	**Name of University**	**Sanctioned Strength**	**Existing Strength**
1	NEHU	467	310
2	MZU	314	237
	Total	**781**	**547**

Source: AQAR of NEHU & MZU, 2019-20

Research Design

Research design is a crucial component of the research process. It refers to the overall strategy or blueprint that guides a researcher in conducting their study. A well-structured research design helps ensure that the study is systematic, well-organized, and capable of addressing the research questions or objectives effectively.

Statement of the Problem

Elsevier Author Service (2023, March 21) defines that "Statement of the Problem" is a critical component of research that serves as a concise and clear description of the issues, challenges, or gaps in knowledge that the research aims to address. It provides the context for the research and highlights the significance of the study. Writing a well-defined problem statement is the first step in conducting meaningful research.

The surplus of information available both print and electronic forms, especially through the internet in public domain in the form of subject gate ways, e-books, e-journals, subject and subject concept-based pages etc. as well as the information available through different subscription-based database made available by most host and aggregators play a significant role in teaching, learning and research. Keeping in view, the huge amount of information resources available, library and information science professionals exercise their expertise in managing the resources in a scientific way using the technology and provide access to the same through Internet and Intranet domain so as to maximise its use. In this perspective, it is very important to find out the comfort zone of university faculty members in making prolific use of library resources and others such as consortia-based e-resources for effective decision making in the digital environment. The libraries of both the universities in the present ICT environment are making all out efforts to allow access the resources to the faculties but it all depend upon the skills and competencies of the faculties to access the same for education and research and this has become a practical problem to access and make use of resources.

Objective of the Study

The objectives of the present study are to:

1. Identify the status of e- resources and its allied equipment and infrastructure available in central library of both university
2. Identify the frequency and purpose of using e-resources by faculty members
3. Ascertain the level of skills and competency of faculty members of both the universities in accessing e-resources.

4. To identify programmes or avenues facilitated by the university to promote ICT skills and competencies of faculty members.
5. Assess the ability of the faculty members of both the universities to critically evaluate various e-resources.
6. Identify the level of usage of different library resources to excel in teaching and research.

Research Methodology

Research methodology refers to the practical of the research process. It is the systematic structuring of the research on the approach used to collect, analyze, and interpret quantitative or qualitative data to answer research questions or test hypotheses.

1. Research Sites

The present study is descriptive in design and qualitative in nature. The unit of the study will be individual faculty members of Mizoram University (MZU) and North-Eastern Hill University (NEHU). All faculty members of every existing academic department of both universities are taken into account.

2. Sampling Technique

Stratified proportionate random sampling technique is used to select the respondents, where different academic departments of both the university remain the main strata.

3. Sample Size

No standardised formula was used for determination of sample size rather; structured questionnaire was distributed among faculty members of NEHU and MZU so as to cover all the academic

departments of both universities. Out of the total questionnaire distributed a number of 246 were re-claimed from NEHU while a total of 160 questionnaires were re-claimed from MZU. Thus, the size of the universe for the present study (viz. faculty member of NEHU and MZU) is 547 while the total sample size remains 406 which account to 74% of the total existing faculty strength of NEHU and MZU.

Table 1.2: Details of selection of sample

Sl. No	**Name of University**	**No. of existing faculty member**	**No. of faculty member participated**
1	NEHU	310	246
2	MZU	237	160
	Total	**547**	**406**

Source: Primary data

4. Data Collection

Questionnaire method is applied to solicit opinion from the faculties proportionally represented from all the disciplines of both the universities under study. Structured questionnaire duly designed for the faculty members of MZU and NEHU. Scheduled questionnaire is designed to obtain necessary data from the librarian. Secondary sources will be collected from various literatures and documents such as books, journals, thesis, published and unpublished, etc.

Chapterization

The present study has 5 chapters. Chapter 1 is Introduction which contain road insight into the main context of the research, it also deals in illustrating the details of NEHU and MZU. It contains review of literature and other research methodologies implied for the current study. Chapter

2: The Concept of E-Resources: This chapter contains a comprehensive insight into the concept of e-resources. It dives deeply into its meanings, creation, types, source, structure, etc. Chapter 3: Information and Communication Technology (ICT) Skills and Competencies: This chapter illustrate the meaning of ICT and ICT Skills, it also traces the history of information technology and how is culminate to the present day. Chapter 4: Data Analysis and Interpretations: In this chapter data obtained through the questionnaire is analysed using statistical tools. Chapter 5: Findings Conclusion and Suggestion: This chapter provide details of findings extracted through analysis of the data obtained.

Findings of the study

Findings of the present study are drawn in firm accordance with the objective framed for the study. This study adopted a total of 6 objectives to present clear understanding of underlying concept of the research.

1) Central Library of both NEHU and MZU are subscribed to various types of e-resources, in a broad category e-resources such as E-Books, E-Journals, E-Thesis & Dissertations, Full text E-Database and Bibliographic E-Database are all attained by the central library of both NEHU and MZU

2) Remote access facilities are provided in the central library of both NEHU and MZU. MZU provides remote access to all its users using KNIMBUS software while NEHU provides the same using RemoteXs software.

3) Both University libraries do not have a separate website; however separate webpage is maintained actively in the primary university

website of both NEHU and MZU. These webpages contain several important information regarding the institutes as well as links for several open access resources to more efficient information dissemination.

4) The present study investigate if the libraries of NEHU and MZU are subscribed to some of the most renowned e-resources platform such as JSTOR, Science Direct, Springer Link, Wiley Blackwell, Scopus, Taylor & Francis, Web of Science, IEEE Database, Indiastats and other e-resource database created under Govt. of India initiatives and it is found that central library of both NEHU and MZU are subscribed all these e-resource platform.

5) Majority of the faculty members from both MZU and NEHU spend ample time using a computer on daily basis. The present study shows that frequency of computer usage is highest among Associate Professors as 39% of them use a computer for over 5 hours daily. However frequency of daily computer usage is high among all respondents as majority of the Professors (34%) use a computer for 2-4 hours daily, majority of the Associate Professors (39%) use it for over 5 hours daily and majority of the Assistant Professors (45%) use a computer for 2-4 hours daily. Use of computer among faculty members of both NEHU and MZU tend to be late as out of the total 406 respondents majority of the respondents i.e. 48% tends to use computer only after following a professional career which is almost half of the total respondents.

6) Usage level of various types of e-resources by faculty members of both NEHU and MZU is unevenly distributed. The present study

shows that there are some e-resources that are prevalently used while others are scarcely utilized. Out of the total 406 respondents majority of them i.e. 39% claimed that they often use e-books while only 6% of the total respondents never use e-books. The use of e-books tends to be prevalent among faculty members of NEHU and MZU as more than two-thirds of the respondents claim that they use e-books and almost half of the respondents settled on the higher level of Likert Scale used to measure the frequency of usage.

7) Of all the various types of e-resources, e-journal tends to be the most widely used digital knowledge resource as the majority of the respondents i.e. 40% claim that they always use e-journal on a regular basis while only 5% of the respondents never use e-journals.

8) Among all the given e-resources CD ROM are least used as 50% of the total 406 respondents claim that they never use CD ROM sources and there are no respondents claiming that they always use CD ROM sources.

9) Usage level of online database is also very high among faculty members of NEHU and MZU as majority of respondents claim that they use online database but the frequency of usage tends to differ as the highest number of respondents i.e. 34% claim that they sometimes use online database and 30% of them claims that they often use it however the margin between these two parameters remain significantly low.

10) Use of audio sources tend to show ominous trend as most of the respondents i.e. 30% of the total 406 claim that they use audio sources only sometimes. Majority of the respondents prefer the lower level of Likert Scale use of the present measurement.

11) The use of video sources shows a promising tendency as more than two third of the respondents prefer the higher score in the provided Likert Scale, these may be reflected to the growth of information in the online video portal such as YouTube.

12) As the current research is undertaken among teachers of higher education the purpose of using e-resource tend to align with the nature of service of the respondents. It is found that use of e-resources for preparation of classroom teaching is highest among Professors and Associate Professor while majority of the Assistant Professors use e-resources for the purpose of research publications. It is also found that majority of the respondents prefer to use e-resources for its remote access ability.

13) Among various devices available for accessing e-resources the respondents of all age group highly prefer laptop.

14) Use of e-database is a significant element of the intellectual community in the digital era among various e-databases JSTOR is most widely used database by faculty members of NEHU and MZU while Wiley online library remain the least used database.

15) While measuring the level of skills and competencies in browsing through the web using Likert Scale it is revealed that majority of respondents are good in browsing through the web which is the

second highest score in the scale. However, it is found most of the Professors i.e. 35% have good ability in browsing through the web while only 9% of them claim that they have very poor skills. Among the Associate Professors who take part in the present study most of them i.e. 36% indicate that they have good skill level similarly among the Assistant Professors majority of tem i.e. 35% claimed that they have good skills in browsing through the web. In the overall scenario more than one-third of the respondents indicates that they have fair and above, till excellent skills in browsing through the web for which it can be said that faculty members of both NEHU and MZU are profoundly capable of browsing through the web. It is also found that Google Chrome is the most frequently used web browser among faculty member of NEHU and MZU.

16) Familiarity with different web search engine is very important as it possess different functionality. The present study reveals that google.com is the most familiar search engine among the faculty member of NEHU and MZU as 93% of them are highly familiar and only 1% of the respondents have low familiarity. The present survey also reveals that 62% of the respondents switch to other search engines depending on the nature of their search.

17) While studying the skill and competency in using e-resources it is very important to take into consideration the use of OPAC facilities in the library as it represent convenient and accurate information retrieval. In the present study it is found that among male respondents 81% of them are using OPAC facilities while among

the female respondents 74% of them are using the same. In the overall case 77% of them are using OPAC facilities which are positive sign that majority of the respondents are aware and use computerised information search and retrieval system. The OPAC provide several search value among which 50% of the respondents use the title value which represent the simplest form of search provision in the OPAC and it can be drawn advanced search strategy of OPAC is not highly used among the respondents. As long as information seeking in the web domain is concern majority of the respondents (45%) are using simple keyword search.

18) An important component of ICT skills includes having the ability to locate accurate information. The present study reveals that Science Direct is the most widely used database of scholarly literature as 34% of the respondents always use the database and 28% of the respondents are using other databases provided under the govt. of India initiatives.

19) It is found that most of the respondents are having decent skills in desktop publishing as 35% of the total 406 respondents have Good skills and 23% have Excellent skills in terms of Likert Scale it is revealed that more than half of the respondents have high rating in the scale. It is also found that majority of the male respondents i.e. 66% attain computer proficiency certificates while majority i.e. 51% of the female respondents do not have the same certificates. In the overall case the percentage of respondents (56%) with computer

proficiency certificates is higher than compared to those who do not attain the same i.e. 44%.

20) Those who find their evaluation to be fair and good is 31% each while only 8% find their skill excellent. However, it is found that majority of the respondents benchmark their skills toward the higher ratings of the scale.

21) Majority of the respondents regard publishers' eminence as the best criteria for accepting the relevance of the information.

22) A vast majority of the respondents i.e. 95% of them are aware of predatory journals and 29% of them used the quality of literature content as criteria for indicating predatory journals. In order to tackle the menace of predatory publishing 85% of the male respondents are aware about using journal while 78% of the female respondents are aware of the same facility. Further, Elsevier journal finder remains the most widely used journal finder as 30% of the respondents are using it.

Conclusion

The present study measure the level Information and Communication Technology (ICT) skills and competencies of faculty members of NEHU and MZU with special reference to using e-resources. There are several sets of skills that should be attained for proper and optimise use of e-resources and identifying the incorporation of these skills using various parameters is the main aim of the study. The conclusion has been divided into following sections as raised in the form of the objective of the study

1) Availability of e-resources in NEHU and MZU

Central Library of both NEHU and MZU are well equipped with e-resources. They are both subscribed to various database of e-journals, e-books and other online databases of scholarly content.

1. **Frequency and purpose of using e-resources**

   Faculty members of NEHU and MZU are acquainted to the use of computer rather late in their professional life as most of them started using computer only after following their professional career but interestingly their daily frequency of using computer is highly regular as most of them use computer for above 5 hours every day. Among the various types of e-resources e-journals remain the most highly used e-resources. The chief purpose of using e-resource among the respondents is to prepare themselves for classroom teaching and they prefer to use e-resources due to its remote accessibility.

2. **Skill and competency level of faculty members of NEHU and MZU**

   Most faculty members of NEHU and MZU have good skills in browsing through the web which is an important component of ICT skills and competencies. They are also highly aware of one of the most prominent browser and search engine in the web domain namely, google chrome and google respectively. More than half of the respondents are aware of changing their search engine based on the nature of their search which reflects positive impact on their skill level. Most of the respondents are using WebOPAC facilities provided by the library which shows that they are aware of the

convenient way of retrieving and location information but they mostly used simple title search method.

3. **Programme to develop ICT skills of faculty members**

   Both the universities taken for study take good measure in facilitating events such as seminar, workshop, etc. with the cause to promoting ICT skills of its faculty members meanwhile, most of the respondents claim that they are moderately satisfied to the outcome of such events.

4. **Critical evaluation of e-resources**

   Most of the faculty members have good ability in critical evaluation of e-resources and publisher's eminence is the most used criteria for determining the quality of information sources found over the web. Most of the respondents are well aware of predatory journals and quality of content in the journals is mostly used as criteria for identifying predatory journals. Use of journal finder is interestingly prominent among the faculty members of both MZU and NEHU as Elsevier Journal Finder remain the most used journal finder.

5. **Use of library e-resources to excel in teaching**

   The central library of both NEHU and MZU provide ample collection of information sources for the faculty members to excel in teaching it can be concluded that most of the faculty members of NEHU and MZU are very satisfied in regards to the library support for their teaching-learning process.

Suggestions:

During the research work many areas have been observed for the improvement of ICT skills of faculty members at NEHU and MZU. Following are some suggestions:

1) More hands on workshop should be organised for development of ICT skills.

2) IPR and copyright issues have become an integral part of the ICT based knowledge development and Universities should organise more events to impart knowledge on these issues

3) Libraries of both Universities should make its users more aware to its ICT based services.

4) All academic departments as well as the university in general should make imparting ICT skills it's among its priorities

5) Library of both NEHU and MZU should make more collaboration in developing e-resources, its uses and its users.

CHAPTER 2

THE CONCEPT OF E-RESOURCE

CHAPTER 3

INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) SKILLS AND COMPETENCIES

CHAPTER 4

DATA ANALYSIS, INTERPRETATIONS AND FINDINGS

CHAPTER 5

CONCLUSIONS AND SUGGESTIONS