USE OF OPEN EDUCATIONAL RESOURCES IN SELECT CENTRAL UNIVERSITIES OF NORTH INDIA: AN ANALYTICAL STUDY

A Thesis

Submitted in partial fulfillment of the requirements for the

award of the degree of

DOCTOR OF PHILOSOPHY

in

LIBRARY SCIENCE

By

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Supervised By

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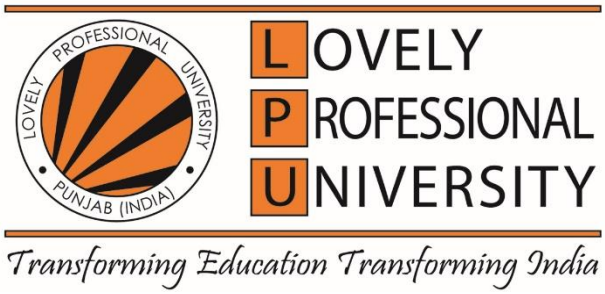

LOVELY PROFESSIONAL UNIVERSITY

PUNJAB

2022

DECLARATION

I hereby declare that the thesis entitled, "**USE OF OPEN EDUCATIONAL RESOURCES IN SELECT CENTRAL UNIVERSITIES OF NORTH INDIA: AN ANALYTICAL STUDY"** submitted to Lovely Professional University in partial fulfillment of the requirements of the degree of Doctor of Philosophy in Library Science is my original work and that the thesis has not formed the basis for the award of any Degree, Diploma, Associateship, Fellowship or any other similar titles.

Madhu

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CERTIFICATE

This is to certify that the thesis entitled, "**USE OF OPEN EDUCATIONAL RESOURCES IN SELECT CENTRAL UNIVERSITIES OF NORTH INDIA: AN ANALYTICAL STUDY"** submitted by Madhu for the award of Doctor of Philosophy in Library Science is a record of research work done under my guidance and supervision during the period 2018-2021 and the thesis has not formed the basis for the award to the scholar of any Degree, Diploma, Associateship, Fellowship or any other similar titles. Also certified that the thesis represents an independent work on the part of the candidate.

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ABSTRACT

Technological advancements and OERs together have opened up wider and bigger opportunities for libraries to access globally created educational resources by different communities and sectors across the globe.

Open educational resources movement is built on the belief that knowledge created with public funds is a public good; anyone can use, access, reuse, and redistribute these educational resources without any constraints. This OER movement is helping libraries and educational communities worldwide by making education more accessible and effective.

The study titled "Use of Open Educational Resources" has been taken up in pursuance of the degree of Doctor of Philosophy (Ph. D) in Library and Information Science. This study would help in understanding the awareness, attitude, and needs of users from the usage of open educational resources perspective. As the study is about four select central universities of North India, it will help in knowing the needs and expectations of users of this area in a better way.

- **Scope of the Study**

The Universities that were selected for the study are:

1) Central University of Punjab (CUP)

2) Central University of Haryana (CUH)

3) Central University of Himachal Pradesh (CUHP)

4) Central University of Jammu (CUJ).

- **Objectives of the Study**

The following objectives are framed for the study;

1) To investigate the status of the use of open educational resources in selected central universities of North India.
2) To analyze the user's perception, awareness, and attitude towards open educational resources.
3) To study the purpose and extent of using open educational resources by the students and faculty of central universities of North India.

4) To study the motivations and constraints in the use of open educational resources by faculty and students of these central universities of North India.
5) To find out the expected role of librarians in providing and promoting Open Educational Resources to their academic community.

Hypotheses of the Study

To achieve the main objectives of this research study, the following hypotheses have been formulated in light of the research objectives of the study. These are as mentioned below:

H_{01}: There is no significant difference among respondents regarding awareness about OER.

H_{02}: There is no significant difference among respondents regarding frequency of using OERs.

H_{03}: There is significant relationship between various constructs of OER and Overall OER Awareness.

H_{04}: There is significant relation between purpose of using OER and Extent of using OER.

H_{05}: There is statistically significant difference in responses regarding problems faced by users in using OERs.

H_{06}: There is statistically significant difference in responses of users regarding the role of librarians in handling their problems.

The study is organized into the following Chapters:

Chapter 1 - Introduction: The first chapter **'Introduction'** explains the concepts, the emergence of learning resources, digital resources, use of ICT in education, open content, open education philosophy, history, and development of the open educational resources, statement of the problem, need and significance of the study, scope of the study, objectives and hypothesis of the study, limitations of the study and chapter scheme.

Chapter 2 - Review of Literature: The second chapter of this thesis is about **'Review of Literature'**. The published related studies and literature about open educational resources, usage of open educational resources, user perceptions and users' attitude towards open educational resources are reviewed and summarised in this chapter. Various theories, frameworks and models related to OER and role of libraries and librarians towards the promotion and usage of OER are reviewed and presented.

The extensive literature study shows that many authors had conducted different survey and case studies at national and international level to examine the awareness and usage of open educational resources. Most of the studies evolve around the awareness and usage of OERs, users' perception and frequency of using OERs. There is limited literature available on role of libraries and librarians in effective usage and promotion of OERs, expectations of users from libraries regrading OERs and motivators and constraints in effective usage of OERs. Open educational resources is a very broad area and in current digital era it can prove to be a exceptionally wonderful facility for academic fraternity. There is need to conduct more research studies and surveys on effective usage and promotion of open educational resources especially in the context of role of libraries and librarians.

Chapter 3 – Open Educational Resources: Chapter three is about **'Open Educational Resources**. This chapter provides detail about different Open educational Resources initiatives at the Indian and global level. It also explains the history and emergence of open educational resources and also describes the key players in open educational resources movement.

Many open educational resources initiatives at the local, regional, national and international levels have given a boost to this movement to reach scholars and underprivileged students to provide educational material. The movement is getting stronger day by day. Many academic institutions, organisations and Government departments are joining hands in this movement.

Chapter 4 – Research Methodology: The fourth chapter of this thesis deals with the **'Research Methodology'** research design, methodology adopted for this research study, sampling design, samples of the study, tools, and techniques used for the study, and statistical tools applied for the study.

Representative sample and its size, scale or instrument reliability and validity, and use of appropriate data analysis tools and techniques are preliminary steps for conducting valid research. It has been done in the light of data type and research objectives with the application of appropriate technique of data analysis. Interpretation of research findings has been done in the light of research consonance or dissonance not only validates but also adds value to the research outcomes.

The population of the study comprise of 8463 users and minimum calculated sample size according to Solvin's formula was 382 respondents. However, a sample size of 710 was used in this research. In this research stratified sampling technique was used. A list of respondents

from each strata was prepared and total 1100 respondents were selected randomly from all strata's using stratified random sampling. Finally, 790 responses were received back justifying a response rate of 71.8%. However, 732 questionnaires were completely filled. The respondents not aware of OER, lacking OER knowledge and never used OER were eliminated from the data. Finally, 710 responses were used for data analysis.

A questionnaire was developed with strong literature support in consultation with practitioners and researchers. It was tested and modified with pre-pilot and pilot survey of 50 respondents. Later, major survey was conducted and tested for reliability and validity using the SPSS 26.0 version. The various statistical measures used are such as: **Cronbach's Alpha, Bartlett's test of Sphericity, Correlation, Percentage, Mean (x), Standard Deviation (σ), Chi-Square (χ^2), Analysis of Variance (ANOVA), Communality, Principal Component Analysis, Structural Equation Modelling (SEM). Inter-rate reliability** or **inter-observer reliability** were tested by asking questions to the respondents in two or more different ways.

Test and re-test reliability was also done. The **split half reliability** was also done. Cronbach's Alpha which was suggested by Lee Cronbach in 1951, using SPSS 26.0 version yielded value of more than 0.6 of Cronbach's Alpha.

Face validity was done by selecting reasonable variable and questions within a construct and in the questionnaire. **Content validity** was done for the agreement of experts for content of the instrument. **Discriminant validity** was also done for variables loading only on one factors or construct.

Chapter 5 – Data Analysis and Interpretation: The fifth chapter is about **'Analysis and Interpretation of Data'**. This chapter contains a detailed analysis and interpretation of data.

In this Chapter the data collected through large scale survey was analysed using various statistical techniques. The findings are depicted through tables and figures. The data was analysed objective wise and further hypotheses were also tested. Total six hypotheses were framed and results of hypotheses shows that H_2, H_3, H_4 and H_6 were accepted and H_1, H_5 were partially accepted.

Chapter – 6: The sixth chapter is on **'Conclusion'**. This chapter elaborates the Findings of the study, suggestions for further study, and conclusion of the study. This sixth chapter is followed by a detailed list of references which also includes annexures of the study. The

style used for references and citations is 'The American Psychological Association' (APA) style manual sixth edition.

Major Findings of the Study

- Users are well aware of open educational resources.
- OER awareness is higher in faculty as compared to other users
- Majority of users were aware of CCL.
- Awareness about NPTEL is more than e-PGPathshala.
- YouTube is the most popular OER platform and is used by majority of respondents
- Major purpose of using OERs by respondents is to prepare class notes
- Open Audio/videos are more important OERs for all categories of respondents and Open blogs are the least preferred type of resource.
- Majority of respondents expect that librarians should play an active role in providing and promoting OER
- Important barriers identified include non-availability of OERs in the native language of respondents and other health hazards.

Areas for Further Research

The current study has shown the use and awareness of open educational resources in the four Central Universities of North India. The present study is limited only to central universities of North India.

- Similar research may be conducted on the state universities of any region.
- Similar research can be conducted such as on PG students of humanities who are less research minded.
- Similar research may be conducted on the Research on the perception of the quality of OERs and identification of quality indicators of Indian OER content say in social sciences.
- Impact of use of OERs on the quality and productivity of faculty and Research scholars in social sciences.

- Role of Librarians in effective usage and promotion of OERs.
- Comparative study between the use of subscribed textbooks and OERs.

It is suggested that further research in future may be conducted covering wide range of educational institutions across the country. The chances are there that reputation, accreditations, funding pattern, geographical location, and infrastructure shall also impact availability and access of OER. Also, there is a need to develop a culture of self-learning and thinking out of box to match OER offered with interest and needs of users for their better future prospects. Finally, there is a need to benchmark OER strategy to not only to gain international market share but also in the best interest of humanity across the globe.

ACKNOWLEDGEMENTS

I am blessed to have the mercy of my revered Spiritual Gurudev Sri Srimad Bhakti Vigyan Bharti Goswami Maharaj.

I would whole heartedly like to thank the Almighty for all the wisdom perseverance that He has showered upon me during my thesis and throughout my life. A thesis involves numerous activities and association of many people. The amount of contribution made by each one of them cannot be measured and absence of this contribution would have made this project impossible. I take this opportunity to thank all those who have helped me in the completion of this work.

At the very outset, I express my deep gratitude and thankfulness to my guide ***Dr. Jatinder Kumar,*** *Librarian and Head,* Department of Library & Information Science, Lovely Professional University, Phagwara whose scholarly guidance and unflinching commitment to academic values led to submission of this thesis. He has been unstinting in giving me his precious time and ideas despite his busy schedule and other onerous responsibilities.

I' am deeply beholden to my teacher Prof (Dr.) M. P Satija ji, Emeritus Professor, Guru Nanak Dev University, Amritsar for his in-depth expertise which steered in me the right direction for research. He, with his substance of a genius taught me how to learn. He was always accessible and gave generously all his time with his continuous guidance and encouragement.

I am also thankful to Dr. Baljinder Kaur, Asstt Professor, Punjabi University, Patiala for her whole hearted support.

The data collection period was the most interesting part of my research journey, in the course of which I visited four central universities of North India. I would also like to thank all the members of staff from the four university libraries for cooperating with me in the collection of data. I wish to thank all the respondents of my research for taking the time to fill the lengthy questionnaire with all enthusiasm.

I would also like to express my immense thankfulness and gratitude to learned authors whose work I have consulted and who have been listed in references.

I would also like to acknowledge the contribution of my seniors, my staff members, my friends and colleagues for their valuable insights in my research and being a moral support throughout.

Above all, I owe more than I could express my immense gratitude to my husband Manish Kumar who has always been there for everything and in every way, he could help me from accompanying me to universities for data collection to helping me in managing my personal and professional life. I am also thankful to my children Vishnu and Parth for their love and motivation during the completion of my project. The moral support given by family was the greatest pillar of strength for me during entire journey of this project. Last but not least I am thankful to my mother for her love and encouragement and being understanding enough to respect my constraints and my inability to spend more time with her.

Date: **Madhu Midha**

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ABBREVIATIONS

AICTE	All India Council for Technical Education
AMU	Aligarh Muslim University
APA	American Psychological Association
ATOER	Attitude Towards Open Educational Resources
BBC	British Broadcast Corporation
BC	British Columbia
BC	British Columbia
CANARIE	Canadian Network for Advancement of Research Industry and Education
CCL	Creative Commons Licenses
CCRT	Centre for Cultural Resources and Training
CEC	Consortium for Educational Communication
CIET	Central Institute of Education and Technology
CIHR	Canadian Institute of Health Research
CNX	Connexions
COL	Commonwealth of Learning
CUH	Central University of Haryana
CUHP	Central University of Himachal Pradesh
CUJ	Central University of Jammu
CUP	Central University of Punjab
CVR	Content Validity Ratio
DOAB	Directory of Open Access Books
DSIR	Department of Scientific and Industrial Research

DSIR	Department of Scientific and Industrial Research
E&T	Education and Technology
FLOE	Flexible Learning for Open Education
FOSS	Free and Open Access Software
GPL	General Public License
HP	Himachal Pradesh
HRD	Human Resource Development
HTML	Hypertext Markup Language
ICT	Information and Communication Technology
IDRC	Inclusive Design Research Centre
IGNOU	Indira Gandhi National Open University
IIM	Indian Institute of Management
IISc	Indian Institute of Science
IIT	Indian Institute of Technology
IPR	Intellectual Property Rights
IR	Institutional Repository
ISKME	Institute for the Study of Knowledge Management in Education
IT	Information Technology
JRC	Joint research centre
M. Phil	Masters of Philosophy
MERLOT	Multimedia Educational Resources for learning and Teaching.
MIT	Massachusetts Institute of Technology
MOOCs	Massive Open Online Courses
NCERT	National Council of Educational Research and Training
NDL	National Digital Library

NDLTD	Networked Digital Library of Thesis and Dissertations
NIOS	National Institute of Open Schooling
NISCAIR	National institute of Science Communication and Information Resources
NISSAT	National Information System for Science & Technology
NITTTR	National Institute of Technical Teachers Training and Research
NMEICT	National Mission on Education through Information and Communication Technology
NPL	National Physical Laboratory
NPTEL	National Programme on Technology Enhanced Learning
NROER	National repository of open educational resources
NSDL	National Science Digital Library
NSERC	Natural Sciences and Engineering Research Council
OA	Open Access
OABN	Open Access Books Network
OCAD	Ontario College of Art and Design
OCW	Open Course Ware
OD	Open Data
OE	Open Education
OE Global	Open Education Global
OECD	Organisation for Economic Co-operation and Development
OER	Open Educational Resources
OPL	Open Publication Licenses
OSCAR	Open-Source Courseware Animations Repository
PEOU	Perceived Ease of Use
PG	Post Graduate

Ph. D	Doctor of Philosophy
PLAR	Prior Learning Assessment & Recognition
R & D	Research And Development
SPARC	Scholarly Publishing & Academic Resource Coalition
SSHRC	Social Sciences and Humanities Research Council
SWAYAM	Study Webs of Active–Learning for Young Aspiring Minds
TAM	Technology Acceptance Model
TEKRI	Technology Enabled Knowledge Research Institute
TIMT	Tilak Raj Chadha Institute of Management & Technology
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Actions
TTS	Text To Speech
UG	Under Graduate
UGC	University Grants Commission
UK	United Kingdom
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children's Fund
UNO	United Nations Organization
USA	United States of America
UTAUT	Unified Theory of Acceptance and Use of Technology

Chapter 1

INTRODUCTION

Teaching and learning communities worldwide are developing many educational resources on the internet to be used freely and openly by everyone. These collaborative efforts have given birth to a new world for libraries where every user can freely access, create or contribute to the wealth of human knowledge. The open educational resources movement is nurturing a society where a culture of learning, cooperating, creating, and sharing knowledge is developed among educators.

The open education movement is a combination of the established traditions of resource sharing and using technology in collaboration with other educators and learners who can contribute to use, access, and create content under this open education movement. Libraries are adopting this OER movement to provide their users access to a large number of educational contents without any additional financial burden.

Technological advancements and OERs together have opened up wider and bigger opportunities for libraries to access globally created educational resources by different communities and sectors across the globe.

Open education movements are built on the belief that knowledge created with public funds is a public good; anyone can use, access, reuse, and redistribute these educational resources without any constraints. These Open education movements are helping libraries and educational communities worldwide by making education more accessible and effective.

In this chapter, an effort has been made to cover the overview of open educational resources from the current research study perspective. This chapter presents an overview of the emergence, use, and status of open educational resources and their related terms especially in the context of open learning resources. In this chapter, the rationale of the study, objectives, and scope, etc are also presented. A comprehensive

literature study and an introduction to various ongoing OER projects at the national and international levels are presented in the later chapters of the thesis.

1.1 LEARNING / EDUCATIONAL RESOURCES

Education is a prime factor in the academic, social, political, technological, economic, and actual overall development of any country. Educational or learning resources are an important component of any library, academic institution, and for the teaching-learning process.

According to National Teachers' Institute (2004) "Education resources refer to all human, material, non-material audio-visual environment and community materials available in an academic environment to facilitate administration and simplify the teaching-learning process. They also include other fundamental materials used to make teaching very easy and learning more meaningful and comprehensible to the learners. Educational resources cover all those materials human and non-human, drawn or photographed, built manually or electronically operated, books and all forms of related materials used in teaching and learning process".

OECD (2009) has described a learning resource as follows: "a learning resource can refer either to any resources used by teachers and students for the purpose of learning, or to resources particularly designed to be used in learning settings".

When the term "Educational Resources" is used, it is also open to debate that which content/material will be covered under educational resources, what type of resources, and in which medium those resources should be. Educational resources cover all those materials produced inside or outside academic institutions but used in formal or non-formal learning are considered educational resources. Every educational material actually used for teaching and learning should be considered as educational resources (Geser & Open Learning Content Observatory Services., 2007). The type of resources covered might be any textual course materials, animations, software, simulations, games, etc. The medium of resources might be any educational digital content that may include web pages, radio, YouTube, television, images, scanned/ digitized papers, etc.

1.2 DIGITAL LEARNING RESOURCES

A library has a significant impact on any academic institution and its teaching and learning process. Tech-savvy students, affordable gadgets, advanced technologies, and availability of a large number of learning resources in multiple formats have forced the libraries and librarians to enhance their services, to sharpen their skills, amend their resource delivery ways, and in adopting the ICT in libraries to meet the requirements of the current generation.

In the past few decades, libraries have witnessed paradigm shift in the acquisition, organization, dissemination, and preservation of information and information resources available in digital format (Midha & Kumar, 2022).

In the current scenario, libraries have access to a large number of digital resources that are available in open access via various repositories, databases, and search engines. Such an easy access and availability of digital learning resources has forced a new approach to libraries, educational institutions, educators, and learners.

OECD (2009) has defined digital learning resources as a term "used to refer to any digital resources that are actually used by teachers and learners for the purpose of learning. A digital learning resource is both an artifact and semiotic tool with a potential bigger than traditional textbooks".

In the past few decades, the education sector has witnessed a major paradigm shift both in terms of teaching methods and in terms of educational resources. Print resources have been largely replaced by Digital Learning Resources. This digital transformation has made educational content available and affordable for the communities at large.

1.3 USE OF ICT IN EDUCATION

The various developments in digital technologies have played a catalytic role in the open education movement (Thomas, 2017). ICT has opened up wider and bigger opportunities in the educational world than ever before. Teachers now can share their ideas, research, and knowledge simultaneously with the classroom students and virtually with other students sitting in any other part of the world, and that too at a

reasonable cost or no cost. Students can also learn from many teachers and can easily get any information on any topic instantly. The availability of a large number of search engines and repositories have made the access to digital resources very easy. ICT has made access to digital resources very easy through search engines and repositories. Cohen et al. (2016) have explained that the teaching and learning in any academic institution largely depends upon the way these resources are used and the knowledge and skills applied for using these resources in instructions.

Usman (2016) has explained that "ICT is a potentially powerful tool for extending educational opportunities, both formal and non-formal, to previously underserved constituencies scattered, and rural populations, groups traditionally excluded from education due to cultural or social reasons such as ethnic minorities, girls and women, persons with disabilities, and the elderly through teleconferencing, etc.".

1.4 OPEN CONTENT PHILOSOPHY

Although in current digital age a lot of resources and information is available for use of academicians and researchers, authentic and reliable information to undertake research work and projects is available at high subscription fees. Leacock & Nesbit (2007) have explained that any learning resource is of little use or of no use if its content is inaccurate and misleading. High subscription costs are major barriers in access to scholarly content.

The motive behind the open content philosophy is to make the scholarly content available and accessible to all universally without any financial or copyright restrictions.

In 1969, an open university was established in the UK was a milestone move in the notion of "Openness".

Budapest Open Access Initiative (2002) has defined Open Access as "a term used to describe published academic papers, books, reports and other periodicals that are electronically available to readers without financial or technological barriers. OA materials are those made freely accessible to users by removing price and permission barriers".

According to Adeleke et al. (2017) “the emergence of e-journals with other e-resources has revolutionized the scholarly communication concept. So, the required scientific information to disseminate research information can be done with the help of ICT applications. It also provides self-publishing facilities where ownership of scholarship could be decided by the scholar. Research output can be measured in terms of the number of publications. So, the publication should not be controlled under the publication houses, subscription cost for electronic journals and cost of printed materials force the librarians and professionals to pursue the alternate source of scholarly communication process like Open Access”.

Ed Walker (2009) has defined the term ‘open’ as “convenient, effective, affordable, and sustainable and available to every learner and teacher worldwide”

After the `Open Access and Open-Source Software movements` success, an Open Educational Resources is an extended version of these globally accepted higher education movements towards openness.

“The two most important aspects of openness have to do with free availability over the Internet and as few restrictions as possible on the use of the resource. There should be no technical barriers (undisclosed source code), no price barriers (subscriptions, licensing fees, pay-per-view fees), and as few legal permission barriers as possible (copyright and licensing restrictions) for the end-user. The end-user should be able not only to use or read the resource but also to adapt it, build upon it and thereby reuse it, publish it given that the original creator is attributed for his/her work. In broad terms, this is what is meant with “open” in all three movements” (Hylen, 2015).

Kanwar (2017) mentioned that “Open education is a philosophical construct that refers to policies and practices that allow entry to learning with no or minimum barriers with respect to age, gender or time or financial constraints. In short, openness is about open entry, learning anywhere, anytime and the freedom to choose courses. Educational institutions provide flexibility so that if the learners cannot come to the university, the university goes to the learners”.

1.5 OPEN EDUCATION

“For too long, our educational systems have operated with a fundamental disconnect between practices left over from the analog world, and the vast potential of technology and the Internet to support more affordable, effective teaching and learning. The movement for Open Education seeks to close this gap”. (*Open Education - SPARC*, 2017).

Open Education is a broader term under which many other open initiatives like open sources software, open e-books, open access journals,wikis, Open research outputs, open educational resources, and open education practices can be accommodated.

The term “open education” embraces many policy frameworks, strategic decisions, teaching and learning methodologies, collaborations in peer academic groups at the individual or institution level, recognition of non-formal learning, and making the content available in different ways.

The European Commission's definition of open education is:

"a way of carrying out education, often using digital technologies. Its aim is to widen access and participation to everyone by removing barriers and making learning accessible, abundant, and customizable for all. It offers multiple ways of teaching and learning, building and sharing knowledge. It also provides a variety of access routes to formal and non-formal education, and connects"(Inamorato et al., 2016.)(European Commission)

Open Education is a “Mode of realizing education, often enabled by digital technologies, aiming to widen access and participation to everyone by removing barriers and making learning accessible, abundant, and customizable for all. It offers multiple ways of teaching and learning, building and sharing knowledge, as well as a variety of access routes to formal and non-formal education, bridging them. (Queromi, 2017)

There are four main rationales to become involved in OE:

- the public mission of higher education institutions (HEIs) -to spread knowledge, widen participation;

- costs containment;
- institutional enhancement and reputation;
- increasing quality of learning for regular students. (OpenCases - Publications Office of the EU, 2017)

1.6 OPEN EDUCATIONAL RESOURCES

Open educational resources movement is an extended version of open access movement that particularly caters to the course curriculum related educational content requirements of teaching and learning community. Smith & Casserly (2006) have explained that open access is not the only feature of open educational resources that distinguishes it from the other content available over the internet. OERs available with open license also permits the users not only to use the resources but also to modify, share and reuse it.

Open Educational Resources is a combination of three words Open + Educational + Resources. This means those electronic resources which cover educational content e.g., Textbooks, lecture notes, course material, full courses, etc. and are openly available to the teaching and learning community with open licenses for use, adapt, and reuse it without any cost.

Many factors have played an important role in the emergence and introduction of open educational resources such as the availability of a large number of resources in digital format, government initiatives and projects, universal missions on digital literacy and education for all, price hikes for textbooks and subscribed contents and budgetary constraints for libraries motivated the libraries and librarians in adopting and providing access to open educational resources.

“Open educational resources are most commonly understood in different ways by different communities and users. The open educational resources are usually online educational content that is available with an open license (usually with creative commons license). The most common synonyms used for open educational resources are open content, open learning objects, and open learning resources” (Midha & Kumar, 2022).

Open Educational Resources (OER) are teaching, learning, and research materials in any medium – digital or otherwise – that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation, and redistribution by others with no or limited restrictions. OER form part of 'Open Solutions', alongside Free and Open-Source Software (FOSS), Open Access (OA), Open Data (OD), and crowd-sourcing platforms (UNESCO,2002).

Open Educational Resources refers to all that teaching and learning resources encompasses all types of textbooks, course materials, images, videos, games, Audio/Video lectures, open software, simulations, research data, research papers, and research outputs, etc that are available in digital format and that are free of charge.

There are two main characteristics of OER: 'Libre' and 'Gratis'. OER is content that is 'Libre' (openly licensed) and 'Gratis' (free of cost/charge) at the same time.

'Libre' means content that is available with an open license (Fully licensed or partially licensed). All content that is available in the public domain is also referred under this category.

This availability of OER with an open license makes the use of OER much easier which otherwise is restricted or refrained due to copyright infringements. This open license grants permissions to users to use the content, remix it, revise it, readapt it, redistribute or share it depending upon the type of license applied to that particular content. 'Gratis' means content that is free of charge digital content but copyrighted, which means users can use this digital content free of cost but if they want to reuse, remix, redistribute or share, etc then they need to take the permission from the copyright holder.

Gratis or free of cost may include individual educational content or full course material etc (i.e MOOCs or online courses etc).

William and Flora Hewlett Foundation has described Open Educational Resources as "OER are teaching, learning, and research resources that reside in the public domain or have been released under an intellectual property license that permits their free use or re-purposing by others. OER include full courses, course materials, modules,

textbooks, streaming videos, tests, software, and any other tools, material or techniques used to support access to knowledge" (Hewlett Foundation, 2016)

UNESCO (2012) has defined OER as "… technology-enabled, open provision of educational resources for consultation, use, and adaptation by a community of users for non-commercial purposes. They are typically made freely available over the web or the internet. Their principal use is by teachers and educational institutions to support course development, but they can also be used directly by students. Open Educational Resources include learning objects such as lecture material, references and readings, simulations experiments and demonstrations as well as syllabi, curricula and teachers' guide."

According to OECD (2007), OER Includes "i) Learning Content: Full courses, course materials, content modules, learning objects, collections and journals. ii) Tools: Software to support the creation, delivery, use, and improvement of open learning content including searching and organization of content, content and learning management systems, content development tools, and online learning communities. iii) Implementation Resources: Intellectual property licenses to promote open publishing of materials, design principles and localization of content".

Atkins et al. (2007) had mentioned" OER include full courses, course materials, modules, textbooks, streaming videos, tests, software and any other tools, materials, or techniques used to support access to knowledge".

Schaffert and Geser (2008) have explained "four core attributes to OERs: i) Open access: content is provided free of charge, ii) Open license: liberal licenses to enable re-use and re-purposing, iii) Open format: produced in an openformat with functionality that allows for easy reuse, iv) Open software: produced with open-source software".

Torres (2013) advocates the OER concept as "OER is the freedom to share knowledge and that knowledge should be legally, socially and technologically open".

As per Cape Town Open Education Declaration (2007) "Open education is not limited to just open educational resources. It also draws upon open technologies that

facilitate collaborative, flexible learning and the open sharing of teaching practices that empower educators to benefit from the best ideas of their colleagues. It may also grow to include new approaches to assessment, accreditation, and collaborative learning. Understanding and embracing innovations like these are critical to the long-term vision of this movement".

According to Navarrete et al. (2016) "OER are becoming a valuable alternative to improve access to high-quality educational content released under open licenses by outstanding universities worldwide. The conjunction of both concepts can configure a strategy to improve the quality of the curricula in the higher educational institutions, particularly in developing countries, to equalize the learning outcomes of international academic programs and to reduce the cost associated with educational content development".

Wiley (2018) has suggested 5Rs (Retain, Reuse, Revise, Remix, and Redistribute) in regards to the openness and ownership. This model can be used to explain some of the rights that can be incorporated with the development and use of OER.

Although learning resources are often considered as key intellectual property in a competitive higher education world, more and more institutions and individuals are sharing their digital learning resources over the Internet openly and for free, as Open Educational Resources. (Hylén et al., 2012)

1.7 STATEMENT OF THE PROBLEM

Due to advancements in Information and communication technologies (ICT), a large number of educational resources are available online. These online educational resources not only include subscription-based resources but also include freely available online educational resources. Such educational content is mainly produced by higher educational institutions, academic organizations, universities, government, research organization, and intellectuals and this content is made free of cost available on various platforms to be universally accessed, used, and shared without copyright restrictions, etc. are popularly known as Open Educational Resources. Thus, plenty

of scholarly resources are available for the academic community but the potential users of these educational resources are not well aware of their existence.

Abeywardena et al. (2012) in their study have mentioned that the use and reuse of OERs are inhibited due to social, technological, and economic factor. Ossiannilsson & Creelman (2011) mentioned that there is a need of developing a culture so that open educational resources can be embedded into educational environments. The awareness of open educational resources varies from one institution to another and among different categories of users also.

The present study focuses on identifying the awareness of faculty, research scholars, undergraduate and postgraduate students of four central universities of North India. The study also intends to find the purpose and extent of using OER, attitude, motivators, and constraints in the use of open educational resources. Thus, the present study is entitled "Use of Open Educational Resources in select central universities of North India".

1.8 NEED OF THE STUDY

Open educational resources are one of the most significant innovative provisions in the higher education systems that facilitate the universal availability and access to scholarly content. In the present era, most of the traditional resources are being converted into electronic and ICT-enabled resources that include e-books, e-journals, e-newspapers, e-databases, online databases, open-source software, and many more such resources. The availability of open educational resources has facilitated access to scholarly information free to all. A large number of higher education institutions, universities, academic organizations, and intellectuals are contributing and uploading their educational content free of all on different platforms for free and open access by all. Moreover, the open educational resources are very useful for the students, for the research scholars, and for the teachers of higher educational institutions like Arts and Science Colleges, Engineering Colleges, Education Colleges, and Universities for the creation of new and innovative knowledge in arts, humanities, engineering and science & technology.

The current generation spends most of their time on smartphones and on the latest handheld gadgets, etc. They prefer to study the material on digital screens than in the print format. Many publishers understanding the needs of current generation of users are providing content only in electronic versions and have discontinued print versions. Additionally, due to increased textbooks costs, users try to find out the online and free-of-cost availability of these educational materials. In such cases, Open educational Resources become extremely useful for them.

A librarian plays a major role in promoting awareness and providing access to these resources to academic community. The academic community in the higher education system consists of students, research scholars, and faculty members of various ranks such as Assistant Professors, Associate Professors, Research Fellows, Professors, and so on.

1.9 OBJECTIVES OF THE STUDY

The following objectives are framed for the study;

1) To investigate the status of the use of open educational resources in selected central universities of North India.

2) To analyze the user's perception, awareness, and attitude towards open educational resources.

3) To study the purpose and extent of using open educational resources by the students and faculty of central universities of North India.

4) To study the motivations and constraints in the use of open educational resources by faculty and students of these central universities of North India.

5) To find out the expected role of librarians in providing and promoting Open Educational Resources to their academic community.

1.10 HYPOTHESES OF THE STUDY

To achieve the main objectives of this research study, the following hypotheses have been formulated in light of the research objectives of the study. These are as mentioned below:

H_{01}: There is no significant difference among respondents regarding awareness about OER.

H_{02}: There is no significant difference among respondents regarding frequency of using OERs.

H_{03}: There is significant relationship between various constructs of OER and Overall OER Awareness.

H_{04}: There is significant relation between purpose of using OER and Extent of using OER.

H_{05}: There is statistically significant difference in responses regarding problems faced by users in using OERs.

H_{06}: There is statistically significant difference in responses of users regarding the role of librarians in handling their problems.

1.11 SCOPE OF THE STUDY

There are at present 10 central Universities in North India. The list of these universities is shown in Table 1.1. Out of ten central universities in North India the four central universities as mentioned in Table 1.3 have been selected for the present study. The criteria adopted for selecting these universities is their year of establishments. All the universities selected are recently established universities and are just ten-year-old as shown in Table 1.2. All these four universities were established by the Central Universities Act no 25 of 2009. The central universities are funded and governed by the central government and are pioneer in adopting government initiatives and recently central government has taken many initiatives in promoting digital India such as Swayam, NPTEL, NDL, and MOOCs, e Pg Pathshala, Gyankosh etc to provide free open educational resources to the academic community. Most of these open educational resource initiatives are also funded by the central or state governments or government organisations. The Selected four universities are playing active role in promotion and providing access to open educational resources to its users and the same is evident from the websites of these selected universities. The study would help in analyzing the effective usage and

users' behaviour towards these Open Educational Resources. However, for the present study, only four Central University libraries have been selected established after 2009 (excluding Kashmir and UP). The list of the central universities that were selected for the study is given in Table 1.2.

Table 1.1: List of Central Universities in North India (As on March 2019)

Sr.No	State	Name of the University	Year of Establishment
1	Jammu	Central University of Jammu	2011
2	Kashmir	Central University of Kashmir	2011
3	Himachal Pradesh	Central University of Himachal Pradesh	2010
4	Punjab	Central University of Punjab	2009
5	Haryana	Central University of Haryana	2009
6	Uttar Pradesh	Aligarh Muslim University	1875
7		Babasaheb Bhimrao Ambedkar University	1996
8		Banaras Hindu University	1916
9		Rajiv Gandhi National Aviation University	2013
10		University of Allahabad	1887

Table 1.2: Selected Central University libraries in North India for the present study

S.No	Central Universities of North India	Year of Establishment
1	Central University of Punjab, Bathinda	2009
2	Central University of Haryana, Mahendragarh, Haryana	2009
3	Central University of Himachal Pradesh, Dharamshala, HP	2009
4	Central University of Jammu, Jammu	2009

1.12 PROFILE OF SELECTED UNIVERSITIES

As shown in Table 1.2 four central universities of North India were selected for the current study. The brief profile of these four universities and the brief about OER related services being provided by their libraries are as follows.

1.12.1 Central University of Punjab

The Central University of Punjab, has been established in 2009 along with other new Central Universities by an Act of Parliament (No 25, of 2009). The University is accredited 'A' grade in 2016 in first accreditation cycle by NAAC and has secured 95th rank in the year 2019 in the University category of NIRF. It is credited with highest per capita research funding. The university has a mission of providing a wide range of instructional and research facilities across integrated and cross-disciplines, promote innovation in teaching, learning and research, and cross-pollinate new ideas, new technologies and new world-views. It aims to create an ignited workforce responsive to regional, national and global needs in tune with the requirements of academia, industry and business. The university is resorting to e-governance through Samarth Project.

The university started in a three-room Camp Office provided by the state administration in March 2009. Making a modest but speedy start, the university accepted on rent, a dilapidated campus of 37 acres of an abandoned co-operative spinning mill on Mansa Road, Bathinda. University is now expanded in the 500 acre of land in Ghudda village. The campus is environment-friendly and energy-efficient and its Master Plan has provisionally been certified with a five-star rating by GRIHA Council and TERI. It has 31 departments and 11 schools in Sciences, Technology, Education, Humanities, Social Sciences and Law disciplines. It offers PG and Ph.D. programmes in these disciplines. It started with the first batch of 10 students in 4 programmes in August 2009 and currently the University has 1595 masters, 366 doctoral and 21 international students. CBCS was introduced in 2015, a learning outcome-based curriculum in 2018 and graduate attributes-based curriculum will be adopted from the academic session 2021. The curriculum focuses on research, skill development and entrepreneurship.

Besides celebrating international and national commemorative days, students are encouraged to organise and participate in sports and cultural events. The University is committed to the social cause and provides opportunities for students to participate actively in all flagship programmes of Govt. of India and also indigenous sports, Food Carnival and Best out of Waste events. The university campus is a plastic-free campus and the university undertakes environmental promotional activities in the adopted villages to create awareness in the society.

The University has been a forerunner in terms of research projects and publications amongst the newly established Central Universities which is evident from the Faculty to Projects and Faculty to Publications Ratio. The University has implemented an Earn-While-You-Learn scheme for financially weak students since 2015. Despite the locational disadvantage, the University in a true sense is a multi-cultural mini-India as it has students from 26 states, faculty from 19 states and non-teaching staff from 12 states. With a much-focused approach, the university is undoubtedly poised to write a new chapter on the academic horizon of India Mostly, Faculty are trained the most reputed universities/institutes at India and abroad.

The University Library is on a rapid and consistent path of expansion and development since its inception in 2009, catering to the learning and research requirements of teachers and students of the university. Carefully designed with elegant modular furniture, the library presently has over 48952 titles and subscribes to 38 international and national print journals, the University Library subscribes to a large number of electronic journals through the e-ShodhSindhu Consortium and independently apart from subscribing to 7231 full text online journals through the e-ShodhSindhu Consortium and independently, with access to American Chemical Society, American Physical Society, Annual Reviews, JSTOR, Oxford University Press, Project Muse, Sage, Springer Link, Taylor & Francis, Wiley-Blackwell etc. The University Library has access to all important full text data base including Indiastat.com, DELNET Online, ISID (The Institute for Studies in Industrial Development), JCCC (J-Gate Custom Content for Consortium), Manuparta, Web of Science etc. It is fully air-conditioned and is located at a central place in the

Academic Block with state-of-the-art seating facility, apart from a quiet and restoring ambience. The interior of the library is enabled with Wi-Fi connectivity allowing the users to work within the library by accessing both offline and online resources. This University Library is equipped with Radio Frequency Identification (RFID) and Electro Magnetic Security System (EMSS) providing automated self-service facility for the users and high-end security. It is also equipped with an advanced Online Public Access Catalog (OPAC) and modern reprographic facilities.

1.12.2 Central University of Himachal Pradesh

The Central University of Himachal Pradesh is established under the Central Universities Act 2009 (No. 25 of 2009) enacted by the Parliament. The University is funded and regulated by the University Grants Commission (UGC). The University became functional with the assumption of charge by the first Vice Chancellor on 20th January 2010.

The Central University of Himachal Pradesh strives for Inclusive Access to Excellence in Higher Education and Research to emerge as Premier University of the Country at par with the best Universities of the World in terms of Programme Offerings, Curricular Framework, Pedagogy, Research and Publications.

CUHP Library caters to the information needs of the faculty members, students, research scholars and staffs. CUHP Library collections comprise printed documents such as books, reports, theses, atlases and back volumes of journals. The non-print collections include Books and Magazine's CDs. CUHP Library is a member of INFLIBNET. It has been subscribing e-journals of various digital Libraries. CUHP Library is also a member of Developing Library Network (DELNET) for sharing the resources among its member libraries. CUHP Library is housed in an air-conditioned building for users to pursue their academic and research activities by way of reading books, accessing electronic journals and internet etc. The library is fully automated using SOUL Library Management Software. The university library has prepared a detailed list of large number of openly available online resources and also provides access links of these resources through its university website.

1.12.3 Central University of Haryana

Central University of Haryana is one of the fifteen new Central Universities established by Ministry of Human Resource Development, Government of India (GoI) in XI Five Year Plan (2007-2012) under the Central University Act-2009 of the Parliament.

The University has been accredited with 'A' Grade in the first cycle of NAAC assessment and accreditation conducted in March 2017. The University is fully funded by the University Grants Commission (UGC). Permanent Campus of the University is situated in 488 acres of land at Jant-Pali Villages, Mahendergarh district of Haryana from where CUH is running its academic operations. Presently the University offers 72 academic programmes (UG/PG/Research).

University Logo is conceived with a globe at its center surrounded by holy trinity of three arcs and at the bottom is a shloka taken from 'Neeti Shatkam' written by Bhartihari
The arc at the bottom depicts an open book and a Veena, symbolising University's commitment to meeting the quest for acquiring knolwedge, learning, enlightenment and promoting art and culture.

The arc at the right that depicts processes of science, technology and adventure symbolises the University's commitment to promoting scientific progress and creating a culture of creativity, innovation and enquiring approach.
The arc at the left that depicts nature symbolizes University's commitment to promoting education inculcating respect for environment, ecology and living in harmony with nature.

The globe at the center surrounded by the human chain and the pigeon flying above expresses University's belief that commitments represented by the trinity of three arcs shall lead to global peace, prosperity and human solidarity-the real spirit of education. The shloka at the bottom conveys that 'education' is the unrivalled treasure of all.

Central University of Haryana which has been awarded 'A' grade by the National Assessment and Accreditation Council (NAAC), is continuously developing its

capabilities The university is on the path of development with new thinking, mutual cooperation and partnership. The university is making special efforts for the education of the students as well as for skill development and placement. For this, the facility of Training and Placement Centre has also been developed in Gurugram.

CUH is moving ahead keeping the goal of all round development of the students at the center. The University is engaged in research, research-innovation, skill development as well as developing opportunities for employment generation. The University is striving to develop necessary modern facilities for the students in the field of higher education. In the direction of successful implementation of National Education Policy-2020, the university is moving ahead in a planned manner and for skill development and employment generation of the students, the university is working at the micro level through special training and placement centers. CUH is moving towards realizing the dream of Self-reliant India, Saksham Bharat & Strong India as shown by Prime Minister Shri Narendra Modi.

The University Library System comprises Pandit Deendayal Upadhyaya Central Library and School Libraries viz. School of Engineering and Technology Library, Swami Dayanand Saraswati Chair Library, School of Law Library and School of Education Library. We work closely with the faculties, administrative staff and other facilities at the University. Our libraries are the preferred locations for community connections and learning. Our library collection comprises a broad spectrum of academic and popular literature in print as well as in digital formats. We regularly add new collections in response to the demand received from our users and make them accessible as soon as possible. With the trained and qualified staff, we execute many innovative services, provide the best possible facilities and organize meaningful events supporting the teaching, learning, research and publication activities of the University.

1.12.4 Central University of Jammu

The Central University of Jammu came into existence on August 08, 2011, with the appointment of the first Vice-Chancellor. It was established by the Central Universities Act, 2009 (Act No.25 of 2009 read with the Central Universities Act, 2009).

The first academic session (2011-2012) commenced with three Post Graduate courses in English, Economics and Applied Mathematics at Temporary Academic Block-I (TAB-I) at Sidhra bypass road, Jammu. In the next academic session (2012-2013), five PG Courses were added: Computer Science, Educational Studies, Environmental Sciences, Human Resource Management and Travel & Tourism Management in Temporary Academic Block (TAB-II) at Sainik Colony Extension. Since the third session (2013-2014) all the departments are functioning from TAB at Sainik Colony. Four new post graduate courses were introduced in the academic session (2014-2015): National Security Studies; Public Policy & Public Administration; Social Work and Mass Communication & New Media. The University also offers Integrated M-Phil-Ph.D programme in eight subjects. The University carries out its administrative functions from its head office at Bagla, Rahya-Suchani, Distt. Samba. The Central University of Jammu campus is under construction at Village Bagla, Raya Suchani in District Samba, which is at an approximate distance of 25 kms from Jammu.

The library was established in the year 2011 and now catering to 21 departments. It has a collection of 26707 books and 50 journals. The library has a computer lab with 24X7 Wi-Fi facilities for research scholars and students. The library has access to anti-plagiarism software namely URKUND. The library functions on all days.

1.13 LIMITATIONS OF THE STUDY

The scope of the present study is limited only to the four central universities of north India. The study is confined to only faculty, undergraduate students, postgraduate students, and research scholars studying at the main campus of these universities. The off-campus students and centers are not included in the present study. The study was conducted during the academic year 2020-2021 alone.

1.14 CHAPTER SCHEME

The study is presented in six chapters. The chapter details are as follows:

1) Chapter 1- Introduction: The first chapter **'Introduction'** explains the concepts, the emergence of learning resources, digital resources, use of ICT in education,

open content, open education philosophy, history, and development of the open educational resources, statement of the problem, need and significance of the study, scope of the study, objectives and hypothesis of the study, limitations of the study and chapter scheme.

2) Chapter 2- Review of Literature: The second chapter of this thesis is about **'Review of Literature'**. The published related studies and literature about open educational resources, usage of open educational resources, user perceptions and users' attitude towards open educational resources are reviewed and summarised in this chapter. Various theories, frameworks and models related to OER and role of libraries and librarians towards the promotion and usage of OER are reviewed and presented.

3) Chapter 3 – Open Educational Resources: Chapter three is about **'Open Educational Resources**. This chapter provides detail about different Open educational Resources initiatives at the Indian and global level. It also explains the history and emergence of open educational resources and also describes the key players in open educational resources movement.

4) Chapter 4 – Research Methodology: The fourth chapter of this thesis deals with the **'Research Methodology'** research design, methodology adopted for this research study, sampling design, samples of the study, tools, and techniques used for the study, and statistical tools applied for the study.

5) Chapter 5 – Data Analysis and Interpretation: The fifth chapter is about **'Analysis and Interpretation of Data'**. This chapter contains a detailed analysis and interpretation of data.

6) Chapter – VI: The sixth chapter is on **'Conclusion'**. This chapter elaborates the Findings of the study, suggestions for further study, and conclusion of the study. This sixth chapter is followed by a detailed list of references which also includes annexures of the study. The style used for references and citations is 'The American Psychological Association' (APA) style manual sixth edition.

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Chapter 2

REVIEW OF LITERATURE

The extensive literature study is the most significant and essential component of any research. The prime objective of this literature review is to analyze the pragmatic and empirical studies that currently exist on the topic of present study i.e., Open Educational Resources.

Any research actually takes place after the detailed review and study of relevant and available research material on that particular topic. The review of relevant literature plays an important role to understand the previously done related studies, their outcomes, outgoing studies, projects and initiatives, the future scope and the expected outcomes etc. These all forms the base for any researcher to start his research study.

The detailed and comprehensive literature review highlights the already completed studies, their outcomes, conclusions, findings and strengthen the foundations for future scope for further researches. The constructive and innovative research on any specific field is only possible if researcher has undergone detailed and comprehensive review of available studies.

A systematic literature review clearly facilitates in determining the need and significance of present study, helps in finding the research gap and also helps in avoiding unnecessary duplication of research already done.

From the perspective of current study, the reviewed literature has facilitated in enlightening the researcher's knowledge about open educational resources concept in general, faculty and students' perception about open educational resources, about ongoing open educational resources initiatives and projects, different theoretical frameworks and models, role of libraries and librarians and impact of open educational resources on students' performances.

The literature review in this chapter is organized into six major parts (i) Users' familiarity with ICT skills, awareness and usage of e-resources (ii) Users' awareness,

perception and usage of Digital / Institutional Repositories, Open Access and Web Resources (iii) Users' awareness, perception and usage of Open Educational Resources (iv) Role of Libraries and Librarians in effective usage and promotion of OER (v) Theories, frameworks and models related to Open Educational Resources (vi) Motivators and constraints towards OER. The special attention has been paid to users' perception and usage of open educational resources. Total 80 studies from national and international level are identified, reviewed and organized in chronological order. The major sections of the study are as mentioned below:

i) Users' familiarity with ICT skills, awareness, and usage of e-resources

ii) Users' awareness, perception and usage of Digital Repositories/ Institutional Repositories, Open Access and Web Resources

iii) Users' awareness, perception and usage of Open Educational Resources

iv) Role of Libraries and Librarians in effective usage and promotion of OERs

v) Theories, frameworks and models related to Open Educational Resources

vi) Motivators and Constraints towards OER

2.1 USERS FAMILIARITY WITH ICT SKILLS, AWARENESS, AND USAGE OF E-RESOURCES

The users' awareness and familiarity with ICT skills is a pre requisite for the effective usage of any electronic, digital or web-based resources. Total six studies (Sinha et al., 2013, Janakiraman and Subramanian, 2014; Javed, 2015; Salahuddin, 2015; Ahmad, 2017, Neogi & Partap, 2019;) related to user's information literacy skills, awareness and usage of e-resources are reviewed and presented in chronological order as mentioned below:

Sinha et al. (2013) conducted a study in Assam, North east India to find out the ICT literacy and internet usage pattern of library users of Barak Valley. The findings revealed that majority of users were aware about ICT and internet but they face difficulties in accessing resources due to slow internet speed and due to lack of awareness about e resources.

Janaki Raman and Subramanian (2014) conducted a study to examine the utilization of Information and communication technology in R&D libraries in Chennai. The questionnaire method was used to collect responses. The study revealed that all the libraries were well equipped with ICT applications and most of the users were familiar with the various library consortiums, e resources, and open access journals.

To analyze the usage of information sources and need for information literacy among students Salauddin (2015) conducted a study on usage of ICT application in the library of National Physical Laboratory (NPL), Delhi. The study revealed that all the respondents were well aware of the computer and ICT skills. The study also revealed that all the respondents were also well aware of internet, world wide web, other computer related devices and e-resources.

Javed (2015) conducted a research study at AMU, Aligarh. The findings revealed that some research scholars and post graduate students were not aware about the meaning and concept of information literacy. The students think that the concept of information Literacy is related with bibliographic instructions and were not aware about the basic concept of information literacy.

Ahmad (2017) conducted a research study to find information literacy skills of researchers. The population of the study included Ph.D. and M. Phil students of University of Punjab, Pakistan. The study revealed that respondents have satisfactory information literacy skills and have potential to identify information's nature and extent. The respondents perceived that they have satisfactory skills to select appropriate databases and methods required to search desired information. The respondents have capability of retrieving information using variety of search methods. The respondents were also able to ensure reliability, accuracy, validity and authority of information gathered from various sources. The respondents affirmed that they understand ethical and legal issues related with information sources and information technology.

Neogi and Partap, (2019) conducted a study on role of information literacy skills on the use of information resources by teachers. The case study was conducted on the faculty members of Uttarayan college of education, Cooch Behar, West Bengal. The

results of the study showed that large number of respondents had internet literacy, computer literacy and media literacy but they were not aware about the concept of information literacy. Although most of the respondents agreed on the need to organize information literacy programs time to time on different levels for teachers and affirmed that there is relation between use of information and information literacy skills as it enhances their ability and skill to use information. The respondents were interested in joining literacy program regarding use of internet and had shown their deep interest in joining literacy programs regarding use of e resources.

2.2 USERS' AWARENESS, PERCEPTION AND USAGE OF DIGITAL REPOSITORIES/ INSTITUTIONAL REPOSITORIES, OPEN ACCESS AND WEB RESOURCES

Many universities and organizations have made their educational content free of cost available to all by uploading it on their websites in forms of digital repositories/ institutional repositories, in open access and as web resources. The research studies conduct on these topics are placed below:

Mulla (2011) conducted a study on the "use of electronic resources by faculty members in HKBK engineering college in Bangalore". The study revealed that 100% faculty members use electronic resources and affirmed that use of electronic resources has impacted on their academic career and acknowledged that the access to current information as a major benefit of using electronic resources.

Rao Baikady and Mudhol (2011) conducted a study on "Web as a learning resource at the medical college libraries in coastal Karnataka: perception of faculty and students". The major findings of the study revealed that most of the respondents enjoyed using web resources as learning resources and strongly wished to use these resources in future also. Majority of respondents even preferred using web resources than the traditional resources. The strong reasons of preferring web resources over traditional resources as indicate by respondents include a) large number of resources on web as compared to traditional resources b) the web resources are faster and time

saving and c) web resources are more knowledgeable, exhaustive, easy to use and authoritarian.

Thandavamoorthy (2011) conducted a study to assess the researcher's attitude towards usage and depositing their educational content in institutional repositories in Karnataka. The researchers agreed upon publishing and depositing in Institutional repository, so that the research findings can be disseminated well. The study revealed that the print books and journals was the most popular source among the researchers and institutional repository was the second preferred source for them.

Chinnadurai (2013) conducted a study on the use of digital resources by faculty members of engineering colleges in Tamil Nadu state. The study revealed that main purpose of using these online resources was for preparing study material followed by research and literature purpose and to use them for paper submission for conferences and journals. The faculty responded that enhanced teaching and enhanced research are the motivating factors to use these digital resources.

Sohail and Alvi (2013) conducted a study on "Use of web resources by medical science students of Aligarh Muslim University". The findings of the study showed that students were using these resources for improving their knowledge, followed by using these resources for finding the quick information on any topic and for their study and research purpose. The students confirmed that they consider information available on web resources as reliable information.

Jamyjose (2014) conducted a study to ascertain the "Use and Awareness of Open Access Resources among academicians in Kerala". The main purpose of using open access resources by teachers is for writing research article, use them for workshops and seminar's purpose and to use them for research purpose. In response to frequency of using open access resources most of the teachers responded that they use open access resources very often. The teachers of social science discipline were the most frequent users of open access journals.

Awasthi (2015) conducted a study on the open access initiatives and use of institutional repositories. The academic community of five research institutions responded that they have used the institutional repository only few times in a year, 48

% users showed their willingness to self-archive their work in institutional repository and 32 % users suggested to include the refereed material in institutional archives. About 56% of users responded that they had never derived any benefit from the usage of these institutional repositories.

Prince and Saravanan (2015) conducted a study on "Awareness and perception towards open access resources among the users in higher educational institutions in Kanyakumari district". The responses revealed that 62.8% faculty were fully aware of open access resources. About 59.4% use these resources for studying course work, 44.6% use for updating their subject knowledge and 44.9% use open access resources for their research project work. Around 67.9% responded that they are satisfied with open access resources and only 4.7% were not satisfied. About 33.9% respondents had high level of perception towards the use of open access resources.

Shukla (2015) carried out a study on the impact of open access digital repositories on information seeking practices of Indian scientists. From the collected data, it was found that most of the scientists and research scholars were well aware about open access digital repositories and they prefer to seek information via open access digital repositories. The users responded that they use these repositories to update their knowledge, to get access to grey and unpublished works and they use them to compare their research projects and assignments.

Bala et al. (2018) conducted a study on "Awareness of open access resources among the researchers of Punjab Agricultural University, Ludhiana". The study revealed that most of the users use Open Access resources for research work purpose followed by course work. The study revealed that role of mandatory one semester credit course on library and information services and technical writing had a positive impact on their academic knowledge and it was the major source of awareness about open access resources.

Kurian and Nagarajan (2018) conducted a research study on "Awareness and use of open access resources among the research scholars of Annamalai University, Tamil Nadu". The study was conducted on a large number of research scholars i.e., 2751 and total 94.59% research scholars were aware of open access resources. Out of five

different subject faculties engineering and technology faculty spent their maximum time i.e., more than 21 hours a month on using open access resources. Majority of 94.59% research scholars use open access resources for research purpose followed by 84.60% use it for up-to-date information. The study revealed that 91.40% research scholars responded that open e journals were the most preferred open access resources, followed by electronic thesis and dissertation 82.69% as the second most preferred sources, and open archives 6.90% were the least preferred resources.

Manchu and Vasudevan (2018) conducted a study on "Awareness of institutional repositories and Open access publishing among researchers in university of Calicut". The study revealed that respondents were well aware about the institutional repositories but were not aware about open access publishing. Majority of users were using these institutional repositories to improve their scholarly communication. The study further revealed that most of the respondents were ready to publish their research articles in institutional repository and also in open access publishing.

R. Bala and Partap (2018) in their research survey on "Awareness and perception towards open access resources among the students and faculty of management sciences: A case study of TIMT, Yamuna Nagar, Haryana" revealed that about 82.95% respondents were aware about open access resources and were using these resources for the purpose of studying course related material and for writing articles/papers and users showed their satisfaction with open access resources.

Thanuskodi (2019) conducted a study to investigate the use and accessibility of open access resources by PG students of Library & Information Science at Alagappa university. The study revealed that all the 100% respondents were aware about open access resources. The majority of users use these open access resources to update their knowledge.

Akparobore and Omosekejimi (2020) conducted a study on "Faculty members awareness and attitude towards the use of institutional repositories in federal universities in South Nigeria". The aggregate mean 3.0 indicated the high level of awareness of institutional repositories among faculty members. The faculty agreed that they use Institutional repositories to access e journal articles and e book collections for teaching and research.

Anwuli Odiachi and Oyeyemi Obinyan (2020) conducted a study on "Awareness and use of open access resources by basic medical science lecturers". The study was conducted on 71 lecturers of Ambrose Alli University, Ekpoma. The study revealed that 88.10% lecturers were very much aware about open access resources and they become aware of open access resources through library personnel. Among large number of e-resources, e-journals, and e-books were the highly used resources and faculty were using these resources for updating their knowledge and for current awareness.

Dada and Eghworo (2020) conducted a study to find out "Undergraduates' awareness, accessibility and use of electronic information resources in federal university in south west, Nigeria". The respondents agreed that they use electronic information resources to access useful and free databases other than library subscribed resources. Most of the users use these electronic information resources for accessing online news. The respondents use these resources to get information which they are not getting in print materials and also use these resources for preparing their exams, for their assignments, and for project purposes.

Singh & Gupta (2020) conducted a study on "Usage pattern of electronic resources by faculty in some universities of North India". The study conducted on six universities revealed that most of the respondents were aware of e resources. The type of e-resources preferred were e-journals, abstracting and indexing services databases and e-books. The teachers accepted that due to frequent use of e-resources the usage of print resources has decreased visibly.

2.3 USERS AWARENESS, PERCEPTION AND USAGE OF OPEN EDUCATIONAL RESOURCES

A number of research studies have indicated the faculty and students' awareness, attitude, perception and usage of open educational resources. Out of 27 studies, 8 researchers (Masterman et al., 2011; Hurt, 2013; Hu et al., 2015; Rowell, 2015; Alves et al., 2017; Gambo and Aliyu, 2017; Gunasekhra, 2019; Issa et al., 2020) have analyzed the awareness, perception, and usage of OER from the student's perspective whereas other 13 researchers (Rolfe, 2012; Chen and Panda, 2013; Garrote Jurado,

2015; Hayman, 2018; Hussain et al., 2013; Mitchell and Chu, 2014; Perryman and Seal, 2016; ; van der Merwe, 2015) have analyzed it from the faculty's perspective. Six researchers (Bliss et al.,2013; Pounds & Bostock, 2019; Appiah et al., 2020;) have analyzed both the faculty and students' perspectives and some researchers have analyzed it from the other user's perspective.

2.3.1 Users Awareness, Perception and Usage of Open Educational Resources: Students Perspective

Masterman et al. (2011) have revealed that the students of UK higher educational institutions had very little awareness about OERs. Moreover, they had very low level of awareness about IPR. The study revealed that the students were not willing to make their work openly available for others.

Hurt (2013) also revealed similar findings in a university at UK. It was found from the study that majority of students were not aware of OERs. However, few students have heard about some OER repositories and projects.

Hu et al. (2015) conducted a study on "Open Educational Resources: Usage and Barriers: a study from Zhejiang University, China". Around 1239 students participated in this survey. About 78.8% students responded that they had used open educational resources. The students affirmed that they use open educational resources for personal learning, and to view the presentations of international prestigious scholars. The students preferred video format over e-content format and text format for open educational content.

Rowell (2015) in his thesis on students' perception: teaching and learning with OER revealed that students had a positive approach towards OER. However, it appeared that students had yet to develop a definite perception about the values of OER in the courses they take.

Alves et al. (2017) in their study conducted on higher educational institutions students in Portuguese revealed lack of OER awareness and knowledge about OER, its uses and about various OER platforms.

Gambo and Aliyu (2017) conducted a study on "Use of open educational resources and print educational materials by federal college of education, Katsina, Nigeria: A study". The study revealed that 53% students' access OER on daily basis. The students believe that data retrieval on open educational resources is more reliable, OER provide more up to date information, OER help them in making specific information available and enables effective ways of sourcing educational material.

Gunasekara (2019) in his study on review of awareness level of OERs at open university, Sri Lanka revealed that students have moderate awareness about OER. It was found that open university Sri Lanka' investment to promote OERs and to increase the usage of OERs as learning material had impacted on the high OER awareness level of students.

Issa et al. (2020) conducted a research study to investigate the undergraduates' attitude towards the utilization of open educational resources. Out of 6 universities in Kwara state (Nigeria) the researcher selected three universities and three major subject disciplines. The major findings of the study reflected the positive attitude of undergraduates towards the utilization of OER. Both the male and female respondents were equally in favor of utilization of OERs. The researcher purposefully selected three different subject areas to assess whether there was any difference in opinion based on the subject specialization. The findings revealed that there was no significant difference in utilization of OER on the basis of subject specialization.

2.3.2 Users Awareness, Perception and Usage of Open Educational Resources: Faculty Perspective

Rolfe (2012) in a study analyzed the attitude of faculty members towards sharing of resources in a university in the UK and indicated that there was lack of awareness among faculty members about open educational resources. The faculty were interested to share their resources freely only with their own colleagues instead of making these resources available to outside users. Only 12% of faculty members agreed to make their resources available at global level. Richter (2011) also reported

similar type of findings in his study conducted on teachers in Germany the study revealed that teachers were reluctant to share their resources freely at global level.

Reed (2012) conducted a study to find out the level of awareness and participation of educators in open education movement in one of the higher education institutions in United Kingdom. The study revealed that educators had favorable attitude towards open sharing but were not fully aware about creative common licenses and also were reluctant to share their resources at global level repositories related to open educational resources.

Chen and Panda (2013) conducted a study on "Needs for and utilization of open educational resources in distance education: a Chinese survey". The study revealed that 97% teachers were aware about open educational resources and most of them were using OERs on daily basis. Teachers were using OERs in their teaching content, for relevant research findings, for planning their own online courses, and for their professional development and self enhancement.

Hussain et al. (2013) conducted a study on "Attitude of university academies towards the use of open educational resources in higher education". The study was conducted at Islamia university of Bahawalpur, Pakistan and findings revealed that teachers has used OERs for academic purpose, research purposes and for various teaching and learning purposes. The faculty considers OERs as an innovation in learning and they feel these resources are easily available and are easily understandable. Most of the teachers considered 24/7 availability without any space limitations as the most attractive feature of OERs.

Kursun et al. (2014) in a survey involving 1637 faculty members from 56 universities in turkey found that only 23% of faculty members shared their resources whereas 18% were not at all interested in sharing their resources. The study revealed that instead of being a strong supporter of open sharing concept there was a paradox in faculty attitude there was an unresponsive attitude towards sharing or using educational resources developed by someone else.

Mitchell and Chu (2014) conducted a study on "Open educational resources: the new paradigm in academic libraries". The researcher conducted an online survey to find out the faculty's awareness and willingness to contribute in free online scholarly material at California State University, San Marcos, USA. Faculty members affirmed that they were aware of the OER repository provided by their university and are using its resources and they are also willing to contribute their scholarly content in this repository.

Mtebe and Riasamo (2014) conducted a study on faculty members from 22 universities. The study revealed that 93.1% respondents were aware of the concept of open educational resources and 86.1% were willing to share their course material as open educational resources. The result showed that faculty members believed that usage of open educational resources in their course development will make teaching and learning outcome better, quicker and easier. The faculty believes that usage of open educational resources will also save the time of users and users will have wider access to the recent resources. The faculty members were of the opinion that open educational resources are very easy to learn and it is also easy to integrate them in courses.

Garrote Jurado (2015) conducted a study on four groups of lecturers from Cuba, Guatemala, Peru and Brazil. The study revealed that the 100% lecturers from Cuba agreed on use of free course material and showed their willingness to make course material available on internet The faculty from Brazil, Peru, Guatemala were also agreed upon the use of free course material and showed their willingness to make course material available on internet up to some extent. The study revealed that lecturers from Cuba and Brazil exhibited more positive attitude towards open educational resources than the respondents from Peru and Guatemala.

Rodriguez et al. (2015) conducted a study on "The impact of open educational resources in teacher activities: a perception survey". The survey was conducted to find out the perception of teachers on the use of open discovery portal (a web platform to access open educational resources) and to assess the impact of this portal on learning processes. The study revealed that teachers use portal to access open

educational content and services online. The faculty considered portal very easy in use. Teachers feels using open educational resources produced by other countries as a big motivational challenge. Teachers perceived a very positive attitude towards both the resources and services provided by open discovery portal in connection with open educational resources. Teachers affirmed that institution has encouraged them to develop ICT based teaching learning system and has valued the efforts made by the teachers in creating open educational resources. In particular, teachers considered that awareness and knowledge on open educational repositories is very important. Additionally, awareness and knowledge about ICT usage in the work is also very important.

Van der Merwe (2015) conducted a study on high school teachers situated in Durban and Pietermaritzburg. The study revealed that teachers had used open educational resources intensively and the materials produced by other teachers was their most favored material. The teachers like OERs as they are more flexible and moreover teachers can get access to best possible resources. Most of the respondents said they would engage more in using open educational resources if technical support is provided to them.

Perryman and Seal (2016) conducted a study on "Open educational practices and attitudes to openness across India". The results of phase 1 survey showed that open educational resources had a very positive impact on educators' professional growth and also on learners' study performance and overall learning experience. The survey revealed that the faculty consider open licensing important and often share these resources and widely use open educational resources in India. The study revealed that all the 100% respondents were using open educational resources for their professional development and the respondents were using OER for teaching purpose, training purpose, and to improve their non-native language skills. The study further showed that teachers were using open educational resources to compare it with other teaching materials. The educators feel that use of open educational resources has broadened their coverage of curriculum, now they have more up to date knowledge in their subject, they use broader range of teaching and learning methods and positive impact of OER is reflected on the way they teach.

Ozdemir and Bonk (2017) explored the Turkish teachers' awareness and perceptions of OER. The study revealed that although teachers are aware about OER up to some extent but they don't have clarity about the difference between the digital educational content available over internet and openly licensed OERs. The teachers affirm that usage of OER is highly beneficial in improving the academic performance of student.

Hayman (2018) in his research report on "Awareness and Use of open educational resources in Ontario: a preliminary study of post-secondary educators' perspective" revealed that most of the respondents of the survey were familiar with the concept and practices of OER usage in their routine course resource selection. The 70% of respondents were more relied on purchased textbooks and were using OERs only as supplementary course material. There was remarkable difference in the participants of the study on decision making regarding level of agency regarding course resources. As majority of university teachers (82%) were acting as a leader in resource selection for their courses and were taking their own independent decisions whereas only 64% of college teachers were allowed to make independent course selection. About the respondent's choice of open resources most of the respondents indicated YouTube and internet-based web resources as their first OER choice. The overall respondent's awareness about copyright and licensing was much lower than their awareness on OER and open text books.

2.3.3 Users Awareness, Perception and Usage of Open Educational Resources: Other Users' Perspectives.

Bliss et al. (2013) revealed that most of the teachers responded that due to cost of textbooks OER are beneficial both for the students and for the teachers but users indicated that due attention must be paid on the quality of content as they believe that open educational textbooks are of worse quality than traditional textbooks. Overall teachers' decision was assorted on replacing textbooks with OER.

Hatzipanagos and Gregson (2015) conducted a study on "the role of open access and open educational resources: a distance learning perspective". The online survey was conducted in two versions one for librarians and one for course teachers. The

findings of the study showed that most of the respondents were not aware of OERs and creative commons licenses. The respondents indicated that their institute is in process of developing open access materials collection and there is no policy available in their institution about open access materials. The respondents affirmed that they produce and promote open access journals. Librarians confirmed that they provide training and support to their staff and student on how to access open educational resources and in future they will provide open access materials through mobiles and tablets.

Hilton (2016) synthesized 16 studies that examined the OER's influence on learning outcomes of students and faculty and their perception of OER. The study revealed that students generally achieve the self-learning outcomes when OER are utilized and they also save sufficient money on textbooks by using OERs. The study indicates that both the students and faculty are generally positive regarding OER.

Pounds and Bostock (2019) conducted a study on "Open educational resources in higher education courses in Aquaculture and Fisheries: opportunities, barriers and future perspectives". The study was conducted on PG students and teachers from Aquaculture and fisheries subject field placed at Europe, Asia, North and South America, Africa and Oceania. The results drawn showed that 95% respondents use online educational material to learn and 96% use online educational material to prepare their lessons. The study revealed that educators feel open educational resources can be of high quality, OER can save time when preparing their lessons, use of open educational resources can lead to higher quality teaching and use of open educational resources can remove socio economic barriers from educational resources. From the findings, it was concluded that most of the students trust open educational resources if it is associated with any respected university or if it is associated with a respectable researcher. About 92% students agreed upon that the higher educational institutions should offer free online educational material. About 50% teachers revealed that they usually do not look for copyright permission while using open educational resources although teachers had heard of creative commons licensing.

Appiah et al. (2020) conducted a survey to analyze "awareness, attitude and utilization of Open Educational Resources at Kumasi Technical university". The study was conducted on students and faculty of Kumasi Technical University. The results showed that 53.5% teachers were new to the term open educational resources and 85.5% students were not aware about open educational resources. The majority of 64.3% teachers confirmed that they are aware of OER repository and 77.9% students responded that they are not aware of any OER repository being provided by their university. About 51.7% of lecturer and 19.9% students responded that they have used OER repository of Kumasi Technical. Most of the lecturers agreed upon the statement that use of open educational resources is convenient to them and it is easy to use this facility. Most of the students agreed upon that OER repository gives access to academic material, it is easy to use this facility, and it has provided limitless access to study materials.

Kumar et al. (2021) conducted a study on "open educational resources: Issues and problem experienced by social scientists of select higher education institutes in India". The study revealed that although most of the respondents were aware about the open educational resources but many of them, don't know how to access these resources. The respondents were up to some or up to great extent were involved in OER activities and had submitted teaching and learning resources for publications as OER and would continue submitting the same in future also. The respondents confirmed that they had used OER of other academicians in their teaching and research. The respondents affirmed that they had got positive cooperation from people from other parts of the countries in producing and exchanging OER. Most of the respondents were in favour of sharing teaching and learning resources at global level.

2.4 ROLE OF LIBRARIES AND LIBRARIANS IN EFFECTIVE USAGE AND PROMOTION OF OERS

Librarians plays an important role in delivery, promotion and effective usage of open educational resources. Many researchers have explored the role played by librarians and users' expectations from libraries.

Bueno-De-La-Fuente et al. (2012) conducted a survey on "The roles of libraries and information professionals in open educational resources initiatives". Library professionals form 17 countries participated in this online survey. The survey findings showed that there were many different objectives that inspired higher education institutions to adopt open educational resources initiatives and indicated a broad range of strategies and policies behind adoption, creation, storage and releasing of these open educational resources initiatives. Majority of institutions 67% have librarians or information professional's engagement within OER initiatives teams, in 11 institutions library is leading open educational resources initiative and in 12 institutions library is a partner in open educational resources initiative and in another 11 institutions library provide support to organization in their open educational resource effort. The findings revealed that OER initiatives are strongly related to libraries and involvement of librarian would be highly beneficial in such practices. Moreover, librarians can play an important role in development of best practices, guidelines, and recommendations related to OER. Additionally, librarians should develop expertise in specific activities and teaching related to digital content, authoring tools and OER implications.

Cakmak et al. (2012) in their research article on "Open Educational Resources and academic libraries: reflections from Turkey" advocates that OERs provide great opportunities for an increase in knowledge dissemination in accordance with the educational purposes of universities. It is vitally significant and essential for libraries, the main supporter of educational activities at universities with their informational resources to participate directly in OER initiatives and revise their services and collections in the scope of OER. Further, libraries can assist existing OERs by providing better funding aids to OER projects.

Karadia et al. (2015) in his research article on "Open Educational Resources; involvement of libraries and LIS professionals" has advocated that librarian has to play a mediator's role in promotion of OER initiatives and in disseminating OER content. Moreover, librarians should actively engage in management, subject classification, and storage of OER content. Additionally, librarians can also contribute their own educational content in OER repositories, can assist in indexing

and archiving of OER, and can participate in discussions related to IPR and copyrights etc.

ALA and Carmen Kazakoff-Lane (2017) advocate that Libraries can and should support open education. It fits with librarians' professional support for access to information as a public good, the institutional mandate of academic libraries to support teaching and research, and the professional obligations of librarians in public libraries to support continuing education. But before libraries do so, it is useful to understand the open education movement as a whole, including some of the key challenges facing both OERs and MOOCs and how libraries are well positioned to help address these challenges. By taking a holistic approach, libraries can aid the movement to facilitate universal, affordable, quality education for the peoples of the world, and ensure that institutions, faculty, funding agencies, and governments avoid pathways to open education that might prove detrimental to scholarship as well as to society as a whole.

Ontario council of University Libraries (2017) in its white paper on Open educational resources and Orbis Cascade Survey Report explains the roles expected from libraries related to OER includes creation, storage, managing OER, centralized access, curation, preservation, enhancing OER metadata, training and education on OER and advocating institutional policies that support open access, open education and open data.

Sanjeeva and Powdwal (2017) conducted a study on "Open educational resources: Role of libraries". The selected librarians of higher education institution of Mumbai participated in this online survey. The findings of the survey revealed that 44 % librarians are aware of open educational resources and have somehow used these OERs also. About 52% librarians affirmed that they use open educational resources as supplementary course material, whereas use of open educational resources as required course material was very low only 10% responded in favor of this, 26% librarians were not aware about the use of open educational resources in their institutions. The study further revealed that librarian's awareness about open educational resources in general was high, but 54% librarians were not aware about

involvement of their faculty members in creation of open educational resources. Majority of 56% of Librarians were aware about availability of full course material as open educational resources, 40% were aware about open textbooks and 32% were aware about open course ware and 30% were aware about OER videos. About the active involvement of libraries in OER 62.5% affirmed that although they are aware about OER initiatives but their institute library is not involved in it whereas 37% librarians responded positively and affirmed that their library is a partner in open educational resource initiatives. Majority of librarians 76% responded that they have provided links to open educational resources in their library page followed by 46% librarians that has included open educational resources in their library's e-resources collection for the easy search and only 16.7% have included open educational resources in their libraries subject reading lists. About the barriers in open educational resources most of the librarians revealed lack of awareness about open educational resources and about copyright issues and lack of time for creating and using open educational resources and lack of skills required in selecting open educational resources as major barriers. Overall, librarians had very positive attitude towards open educational resources and 63.2% librarians were willing to promote and support open educational resources in future.

Mtumwa Mwinyimbegu (2018) conducted a study on the role of libraries and librarians in open educational resources in Tanzania: the case of selected public libraries". The study was conducted at four universities under Dar es Salaam, Tanzania. The findings show that librarians play an active role in OER activities. About 50% of the librarians host open educational resources on their library websites, Librarians said they host open educational resources on their websites because they are freely available and host them because of easy access. About 70% librarians responded that they play active role in promotion of open educational resources, followed by 47% they play role in integration of open educational resources and 13.8% in guiding, 13.1% in dissemination of open educational resources and 11.5% in management of open educational resources. About 17.6% librarians said they have integrated various open educational resources on their websites, 16.8% said they have open educational resources through their library

information management information system and 12.2% have linked open educational resources to open access repository. In response to challenges faced by librarians 88.5% indicated low level of awareness about existing open educational resources, followed by 69.2% said they lack of policy guiding the use of open educational resources and 67.3% said inadequate bandwidth as a constraint in promotion, creation and dissemination of open educational resources.

Kumar Upneja (2020) conducted a study on "contribution of library professionals and libraries in Open educational resources in Indian scenario". The survey included library professionals, scholars, students, faculty and trainees working in different academic, special or public libraries. The study revealed that 53% of respondents were slightly aware of open educational resources and 30% were highly aware of open educational resources. Only few institutions had a policy document on open educational resources and 58% said they have no such policy document available at their institute. About the role of librarians in open educational resources 15.63% believed that librarians can play role in promotion of OER, 14.02% in identification, 13.21% in guiding users, 12.96% in collection and 12.53% in Management and 11.05% believed that librarians can play active role in dissemination of open educational resources. About the ways for promoting awareness on open educational resources 14.46 % believes that library should use orientations programs, 13.13% thinks training programs, 11.01% thinks library websites should be used for OER promotions and 10.88% think use of social media and another 9.28% think seminar and workshops should be conducted for promotion of open educational resources.

2.5 THEORIES, FRAMEWORKS AND MODELS RELATED TO OPEN EDUCATIONAL RESOURCES

Many researchers have proposed a number of models, frameworks and theories related to adoption and acceptance of innovative OER technologies. Few popular research studies are briefed below:

Rogers (2003) has proposed the "Diffusion of Innovation theory". To understand the theory (Rogers, 2003) has provided a framework which defines "a process by which

an innovation is communicated through a certain channel over a period of time among the different members of a social system". The "Diffusion of innovation theory" has four key elements a) innovation b) channel of communication c) social system and d) time. Roger (2003) has further described the five categories of adopters that contains i) innovators ii) early adopters iii) early majority iv) late majority and v) laggards. The theory of diffusion of innovation has been divided into three main components that is 1) innovation decision process 2) attributes of an innovation and 3) adopter characteristics.

On the basis of "The Diffusion of Innovation theory" and the "Theory of social learning", Marcus (1986) has further developed a theory named "Theoretical model of adoption". This model of adoption has highlighted the various factors that are related to the innovation adoption such as tools, training, funds, experience, time and the relevant skills. Marcus (1986) in this theoretical model has discussed the functions of various available resources and the value that is attributed to any communication channel that facilitates in learning about that innovation.

Fishbein and Ajzen (1975) have proposed the 'Theory of Reasoned Actions (TRA)'. This theory is based on social psychology and is extensively used for explanations related with adoption of technology. As an extension of theory of reasoned actions Davis (1989) developed Technology Acceptance Model (TAM). This TAM model describes that any individual's attitude towards acceptance ad use of technology depends upon two important factors one is PEOU (Perceived Ease of Use) and other is PU (Perceived Usefulness). To address the limitations of Theory of reasoned Actions Ajzen (1991) proposed "Theory of Planned Behavior". This theory is considered as an extension of TRA. This theory has three main attributes (1) Attitude towards behavior (ii) Subjective norms and (iii) Perceived behavioral control. Taylor and Todd (1995) proposed "Decomposed theory of Planned Behavior" This model is an extended version of Theory of Planned behavior (TPB) and Technology Acceptance Model (TAM). This theory explains that attitude directly affect the behavioral intention. Advantage, Complexity, and compatibility influence the attitude and behavior. This theory is used for better understanding of literature derived from the IT usage.

Technology, Organization, and environment framework was introduced by DePietro et al (1990**).** This framework has defined three elements (i) Environment (ii) Organization and (iii) Technology. These three elements play an important role influencing the implementation and adoption of technology. The UTAUT theory was developed by Venkatesh et al. (2003). This theory is based on eight earlier proposed theories users' acceptance and motivation models. UTAUT theory explains that three core elements directly effect on the intention to use (i) Performance expectancy (ii) Effort Expectancy (iii) Social Influence.

All these proposed models and theories are very comprehensive, well tested and tried and have very strong theoretical foundations. For understanding the adoption of ICT, Theory of Reasoned Actions and Technology Acceptance Model are most widely used models to understand the adoption of ICT at individual levels. Whereas, Marcus's theory of Adoption is used for understanding the ICT adoption at organization level. For studying the innovation in social context, the Diffusion of Innovation Theory is used mostly. The researchers usually use UTAUT model to study the innovations in educational, technological and commercial applications. Many researchers have pointed out the inflexibility of these models to adapt in different context as the major limitations.

For measuring the quality of OERs Kawachi (2014) has reported more than 30 frameworks. These models are used for assessing the purpose and fitness of OER.

This framework proposed by Kawachi (2014) known as TIPS framework suggests a checklist of criteria's that should be considered by teachers during the designing of open educational resources. The framework proposed four groups as Quality concern criteria includes (i) Information and Material content, (ii)Teaching Learning Process (iii)System, Technical and Technological criteria (iv) Product, Presentation and Format.

Jung et al. (2016) have also proposed a model. This model is based on 25 criteria's such as purpose, content, ease of use etc. were used to assess the fitness of OERs.

To analyze the open education practices Ehlers (2011) has proposed a model that include two matrices that facilitate analysis of open educational practices on different groups.

A framework for evaluation and development of OER is briefed by Ean Teng and Sheng Hung (2013). This framework focuses on development phases of OER based learning materials. Creation, evaluation, and production are the three phases evaluated for open and distance learning users.

Mishra et al. (2016) developed a scale to measure faculty attitude towards open educational resources. The model is based on three major constructs for attitude towards open educational resources scale that includes awareness about resources, sharing of resources and adaptation and use of these open educational resources. The three methodologies were adapted for validation, reliability and optimization of attitude towards open educational resources scale. The methodologies include domain identification and item generation, content expert validation and administration of the items to a development sample. Further, the validity of ATOER scale the content validation ratio in four stages was calculated. The ATOER scale development with two factor and 17 items following a consultative process with reliable and valid statistics showed that the scale can be used to measure the attitude towards open educational resources. The final scale of 17 items full satisfaction within acceptable sample size limits and CVR score for final scale was 0.9 and the Cronbach's reliability coefficient alpha was 0.897. For using the scale in practice there are many demographic variables that may also be used to understand the difference due to gender, age, experience and subject domain etc. The scale would help to know whether the teacher would take steps in usage and contribution towards open educational resources. The scale can also be used to explore the feasibility of sharing the educational resources with open license. the scale would also help institutes in planning regarding use of open educational resources and would help in determining the positive or negative attitude of faculty towards its adoption in teaching and learning.

Padhi (2018) conducted a study on "Acceptance and usability of open educational resources in Indian higher education: an investigation using UTAUT model". This UTAUT model holds four key elements: - Performance expectancy, social influence, effort expectancy and facilitating conditions. The findings revealed that most of the respondents were aware of the concept of open educational resources and were willing to share their course material as open educational resources. The four model constructs were assessed and model explains the variance at 51.3% on teachers' intention to use open educational resources. The result showed that faculty members believes that usage of open educational resources in their course development will make teaching and learning outcome better, quicker and easier. The faculty believes that usage of open educational resources will also save the time of users and users will have wider access to the recent resources. The faculty members were of the opinion that open educational resources are easy to learn and also it is easy to integrate them in courses. Teachers responded their concern about insufficient resources and supportive conditions to use open educational resources. They believe that their university may not encourage the use of open educational resources in course curriculum. The faculty members further feel that they do not have required skills and knowledge regarding usage and integration of open educational resources in their courses.

2.6 MOTIVATIONS AND CONSTRAINTS TOWARDS OERS

A number of studies have shown the perceived benefits and barriers that effect the users' attitude and usage towards OERs. In this section, factors that motivate and encourages usage of OERs and barriers that hinders the effective usage of OERs are explained.

2.6.1 Motivations for OER

Appian (2013) revealed that lecturers agreed upon the statement that use of open educational resources is convenient to them and it is easy to use open educational resources facility. The students agreed upon those open educational resources gives access to academic material, it is easy to use open educational resources facility, and open educational resources had provided limitless access to study material.

Bliss et al. (2013) in their study explained that the teachers responded that due to cost of OER textbooks they are beneficial both for the students and teachers but due attention must be paid on the quality of content. Overall, the cost of textbook was the motivator factor but the respondent's decision was mixed on replacing textbooks with OER.

Hussain, Chandio, Sindher (2013) revealed that the faculty considers OERs as an innovation in learning as these resources are easily available and are easily understandable. Most of the teachers mentioned 24/7 availability feature without any space limitations as a biggest motivator. The data revealed that teachers agreed that use of open educational resources has promoted self-directedness among them, they become self-confident, self-motivated and self-regulated. Moreover, use of open educational resources has improved their readability and their communication skills improved. Further, open educational resources saved the travel cost of users and the cost incurred on photocopying is also reduced.

The results of the survey conducted by Mitchell and Chu (2014) showed that the faculty has strong interest in open and free educational resources and the faculty are also very concerned about the textbooks costs hikes. The faculty agreed that use of OER will help them saving money on textbooks.

Merwe (2015) explained that the respondents are interested in open educational resources because they are more flexible and respondents get access to best possible resources. The respondents said they would engage more in using open educational resources if technical support is provided to them.

Mtebe and Raisamo (2014) conducted a study on faculty members from 22 universities in Tanzania. The study revealed that 93.1% respondents were aware of the concept of open educational resources and 86.1% were willing to share their course material as open educational resources. The result showed that faculty members believes that usage of open educational resources in their course development will make teaching and learning outcome better, quicker and easier. The faculty believes that usage of open educational resources will also save the time of users and users will have wider access to the recent resources. The faculty members

are of the opinion that open educational resources are easy to learn and also it is easy to integrate them in courses.

Shukla (2015) found that users responded that they get access to unpublished material, all-time availability of resources, easy and free access as a benefit. Moreover, the single point search and access to all works is also a major benefit of using open educational repositories.

Belikov and Bodily (2016) narrates that the faculty expressed their willingness to explore open education resources due to cost and pedagogical benefits for their students.

Perryman and Seal (2016) in their findings revealed that 80% educators feel that use of open educational resources has broadened their coverage of curriculum and feel now they have more up to date knowledge in their subject and 77% feel that use of open educational resources is reflected on the way they teach and now they use broader range of teaching and learning methods. Most of the faculty were using open educational resources to get new ideas and inspirations, to enhance their professional development and to stay up to date in their subject and were using it as a self-study option.

Gambo and Aliyu (2017) revealed that most of the students responded that they believe data retrieval on open educational resources is more reliable and provide more up to date information, 66.50% believed that open educational resources help them in making specific information available and another 68.10% thinks open educational resources enables effective ways of sourcing educational material.

Ozdemir and Bonk (2017) revealed that most of the teachers affirmed that the easy access feature of OER as the perceived benefit. Further, no-charge aspect and distribution of materials via internet make a huge influence.

Pounds and Bostock (2019) in their study revealed that most of the educators feel open educational resources can be of high quality, OER can save time when preparing their lessons, use of OER can lead to higher quality teaching and use of OER can remove socio economic barriers from educational resources. From the

findings it was concluded that of students trust open educational resources if it's associated with a respected university followed by if it's associated with a respected researcher. About 92% students agreed upon this those higher educational institutions should offer free online educational material.

Kumar Upneja (2020) revealed that about the benefits derived from using open educational resources users responded that they have gained access to best resources by using OERs, they got supplementary reading materials, and they get flexible and lifelong learning as a benefit of using open educational resources.

Kumar et al. (2021) revealed that most of the respondents feel that publishing of OER will enhance the reputation of institute and it will also enhance the personal reputation.

2.6.2 Constraints towards OER

Most of the academic communities and educational institutions are unaware of rapidly growing open educational resources pools. Due to difference licensing schemes, there is always confusion about availability and compatibility of open educational resources. Above all, large part of the world still doesn't have access to internet and ICT which are the pre requisites for any open educational initiatives. To overcome these barriers cape town declaration has adopted three strategies that facilitate in increasing the reach and global impact of open educational resources(Cape Town Open Education Declaration, 2007). Firstly, they encourage the teachers and students for active participation in open educational movement which includes creation, adoption, improvement and collaboration. Secondly, publishers, authors, institutions and teachers are invited and encouraged to share their resources freely under open license. Moreover, to overcome the accessibility barriers it is encouraged to produce resources that can accommodate different technical platforms. Furthermore, it should be disabled friendly and should be accessible where internet is not available. Thirdly, all the stake holders such as educational institutions and government etc. are encouraged to make an open education policy on priority.

Rao Baikady and Mudhol (2011) in their findings revealed that almost half of the respondents affirmed that although their institutes libraries were providing adequate access to the open resources and adequate infrastructure was also provided for easy and comfortable access still the respondents were not able to make full access and use of resources due to lack of computer skills.

As per the findings of Thandavamoorthy (2011) the researchers reported that fear of copying and using their material by other users without taking their permission is a biggest barrier. This barrier is depriving them to contribute in institutional repositories.

Rolfe (2012) in his findings revealed that the newly appointed faculty were more concerned about copyright issues.

Bliss et al (2013) revealed that some teachers and students believe that open educational textbooks are of worse quality than traditional textbooks. The other respondents also cited that technology was a problem along with poor text quality of OER as a major reason they were not interested in OER. The students also revealed that the website's poor functionality and availability of materials in multiple formats as a major drawback.

Chen and Panda (2013) revealed that most of the respondents affirmed that choosing a right OER was a major problem. Moreover, the content was not appropriate, and language was also a major difficulty in using open educational resources.

Hussain et al. (2013) about 86.2% respondents affirmed that intellectual property as the main challenge and another 86.2% affirmed creation of quality content as a challenge. About 81% teachers reported low bandwidth and 71.2% revealed bug and viruses as problems in using open educational resources.

Sohail and Alvi (2013) found slow connectivity as a major barrier in accessing resources. Moreover, too much information retrieval and limited availability of computers were also mentioned as major barriers in accessing web resources.

Hatziphagos (2015) revealed that major constraint reported by respondents was the quality concern of open educational resources and moreover respondents were afraid of adopting it in their curriculum as OER is a new concept and their sustainability is still in question.

Merwe revealed that 82% teachers responded that there is lack of time to develop open educational resources, 70 % said there is lack of time to find and learn to use open educational resources and 44% said there is no reward system for developing resources and 47% said lack of technical and computer skill is a major barrier in using and developing open educational resources.

Belikov and Bodily (2016) in their research study on incentives and barriers to OER adoption a qualitative analysis of faculty perceptions mentions that the most significant response from the faculty was that they want more detailed information on OERs and how they can share their material as OER under open license and additionally where the reliable OERs can be found. The respondents were also interested on quality and outcome of OER. Another significant concern arose by respondents were the institutional support related to evaluation and adoption of OER. Faculty also responded lack of time to evaluate new resources.

Navarrete et al. (2016) conducted a case study on "use of open educational resources in e learning for higher education". The study revealed that information architecture of websites was the major problem. Searching of relevant Open educational resources is a very time consuming as categorization and structuring of resources is different on each website. The study revealed that such problems discourage faculty in using and retrieving open educational resources.

Gambo and Aliyu (2017) explained that the factors affecting usage of Open educational resources were power outrage, followed by fee charged for browsing open educational resources, improper referencing and citations of information resources, difficulty in locating relevant information and browsing in OER and delay in internet connectivity were responded as major constraints in using open educational resources.

Ozdemir and Bonk (2017) revealed that lack of knowledge about licensing and time required to search OER were major constraints. Moreover, the quality of OER was also considered as a barrier for teachers. Similarly, Rowell (2015) also revealed that students find it a big challenge to find a good quality OER that is suitable for a specific course.

Pounds and Bostock (2019) revealed that language was a major barrier for most of the respondents in using open educational resources. Many other agreed upon that altering open educational resources was a difficult task due to their computer format and it is a major challenge for them in using and adopting open educational resources.

Akparobore and Omosekejimi (2020) explained that majority of faculty members considered fear of copyright infringement as the major challenge in the use of OERs, followed by lack of awareness of publishers' policy about deposited works in institutional repository as a barrier in the use of IRs.

Appiah et al. (2020) reported the poor internet connectivity was the major constraint in accessing open educational resources. The students demanded advancement of library resources, awareness about open educational resources and high bandwidth internet connections to improve the usage of open educational resources.

Dada and Eghworo (2020) in their study found that the poor maintenance of electronic information resources by libraries a major challenge, followed by lack of training, insufficient power supply and poor internet connectivity as barriers in accessing the resources.

Kumar Upneja (2020) revealed that lack of awareness on open educational resources existence**,** followed by lack of technical skills and lack of policy document or guidelines for using open educational resources were the major challenged faced by the respondents.

Singh and Gupta (2020) revealed that most of the teachers feel that poor redressal of grievances was a major barrier, followed by low internet speed and inadequate infrastructure as major barriers in accessing e-resources.

Kumar et al. (2021) revealed that most of the respondents feel that lack of skills and lack of awareness are the major constraints. Additionally, respondents feel they don't have interest in open educational resources as content of open educational repository are not of standard quality and no open educational resources are accessible through university website.

2.7 RESEARCH GAP

The extensive literature review has highlighted few gaps in the research. Most of the researchers has examined the user's awareness, perception and usage of open access resources. In the current scenario where large number of academic institutions are uploading and making their content free of cost available for the students in such situations it became important to understand the academic fraternity's awareness, perception and usage about these Open Educational Resources. The librarians play an important role in the access, promotion and availability of open educational resources. It has been observed that very limited studies have been conducted on the users' expectations and effective role played by libraries and librarians in promotion and delivery of OERs. Further, most of the research studies on current topic have been conducted out of India and only two three studies have been conducted in southern states of India. The research gap has been found in status of use, awareness and perception about open educational resources among the academic fraternity of central universities of North India. The effectiveness of any educational resources depends on the awareness about choosing the right content, skills, and methods used to access these resources, usability of these resources, and the learners' and educators' attitude towards these resources.

This study would help in understanding the awareness, attitude, and needs of users from the usage of open educational resources perspective. As the study is about four select central universities of North India, it will help in knowing the needs and expectations of users of this area in a better way. The earlier studies have covered only the southern part of India whereas users' attitudes and needs are different in both parts. Both the South and North parts have different languages, cultures, educational requirements, etc. The study of these two different regions complements

each other. The select central universities are the recently established universities. These universities are about 10-year-old or less. It will help the researcher to analyze the latest trends in collection development among newly established libraries and the role played by libraries in promotion and availability of Open Educational Resources. Moreover, as these universities are funded and governed by the central government and all the open educational initiatives of government are accessible in these institutions and it will also help in better understanding the usage of these open educational resources.

Several attempts have been made by researchers and research organizations to analyze various aspects of open educational resources both in India and abroad. A closer analysis of the available studies shows that no systemic study has been done on the status and use of these open educational resources in central universities of Northern India.

2.8 SUMMARY

The extensive literature study shows that many authors had conducted different survey and case studies at national and international level to examine the awareness and usage of open educational resources. Most of the studies evolve around the awareness and usage of OERs, users' perception and frequency of using OERs. There is limited literature available on role of libraries and librarians in effective usage and promotion of OERs, expectations of users from libraries regrading OERs and motivators and constraints in effective usage of OERs. Open educational resource is a very broad area and in current digital era it can prove to be a exceptionally wonderful facility for academic fraternity. There is need to conduct more research studies and surveys on effective usage and promotion of open educational resources especially in the context of role of libraries and librarians.

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Chapter 3

OPEN EDUCATIONAL RESOURCES

There has been a tremendous growth in the open educational resources in the recent past and large number of universities, government departments and academic organisations are making their resources freely available over the Internet which has become a significant source of open educational content.

The OER movement is built on the belief that anyone can use, access, reuse and redistribute these educational resources without any constraints. Open education movements are helping educational community worldwide in making education more accessible and in making it more effective.

This chapter provides an overview of various open educational resources initiatives/ repositories available at national and international level. This chapter also explains the key role players in open educational movement. This chapter will help the libraries and librarians to know about various initiatives and to incorporate them in their resource delivery and dissemination. The main sections of this chapter are as below:

3.1 What is not an OER

3.2 History and Emergence of Open Educational Resources

3.3 Characteristics of OER

3.4 Sources of OER

3.5 Key role players in OER movement

3.6 OER Initiatives in India

3.7 OER initiatives around the world.

3.1 WHAT IS NOT AN OER

All educational material/ resources that are freely available are not necessarily Open Educational Resources. There are large number of digitized educational resources

that are although available on the world wide web and are providing free online access, but these resources are with some license restrictions. In order to be considered as Open Educational Resources that educational resources must have an open license. The most widely and most commonly used international licensing framework for OER is Creative Commons License.

3.2 HISTORY AND EMERGENCE OF OPEN EDUCATIONAL RESOURCES

Many factors have played significant role in giving impetus to the OER movement. The most important factors include limited number of resources, high subscription fees, high textbook prices, need for collaboration and sharing, possibilities offered by ICT, open sources software and development of repositories.

The two milestone initiatives in open education movement OER and MOOCS have significantly influenced and transformed the education system globally.

Both the open access movement and open educational resources movement has grown simultaneously. In open access movement some initiatives were the key points such as Budapest open access initiative in 2002, Bethesda open access publishing statement in 2003, Berlin declaration on Open access in 2003 etc. (*Berlin-Declaration_Simone-Rieger_MPIWG*, 2003)

The open educational resources movement has grown at global level consistently due to new initiatives, various guidelines and various declarations held. Such consistent initiatives and projects gave a remarkable impetus in stimulating open educational resources movement and played an important role to give this project a universally renowned movement. A few such initiatives are mentioned below:

The open solutions series was started with GNU project. This project was started by Stallman with a vision to provide free software and for this he initiated a mass collaboration project under the aegis of GNU project and later he instituted free software foundation.

Resource sharing among libraries is very common since many decades. In 1987 Commonwealth of Learning was established, since then it is actively engaged in promotion and sharing of knowledge among commonwealth countries.

The term Open-source software was coined by Eric Raymond and Bruce Perens in the year 1997 (Perens, 1999). Wiley and Gurrell (2009) have described that "the concept, which led to the creation of Open Content license, was based on the principles of free/open-source software and the intent of using it in the case of educational materials and other contents".

Later, the term Open content was introduced by Wiley in the year 1998 (Wiley, 2007). In the year 1996 California state university initiated the project Merlot (Rutledge et al., 2001). It was the very first website where the teachers can share their learning material freely and that educational material could be used, searched and evaluated by other teaching communities also.

"Universal access to all knowledge" with this mission the Internet Archive was established in the year 1996. The collection consists of millions of books and billions of downloads per month (Wallace, 2019).

Similarly, like Merlot project, Rice University started their project Connexions (presently named as OpenStax). This Connexions project, an educational content repository was started in 1999 (Dholakia et al., 2006).

In 2000 teachers of eight south African countries initiated the project STAMP 2000+ to collaborate and share free resources and teaching materials in Science, Math and Technology for free use by other commonwealth teachers (Commonwealth of Learning., 2000).

Then came Wikipedia in the year 2001. Wikipedia is one of the utmost popular websites and has a large collection of free articles that includes about 40 million articles available in 290 languages.

The other educational institution which played a major role in Open Educational Resources movement is MIT. In 2001 MIT announced Open Courseware (OCW)

initiative. This one pioneer initiative inspired many other universities around the world to make their educational content freely available for everyone which resulted in formation of open courseware consortium (MIT, 2001).

William and Flora Foundation funded MIT Open course ware project later it sponsored many open educational resources initiatives in many countries (Angela DeBarger & Cathy Casserly, 2021).

Inspired by Stallman's Free Software Foundation Larry Lessig founded Creative Commons in 2001. This movement proved as a major milestone in the promotion of open content phenomenon. Like Stallman's GNU GPL (General Public License) project Creative Commons started Open Publication Licenses (OPL). These licenses were developed for the free and easy use of variety of creative works (Prodromos Tsiavos, 2007).

In 2002 UNESCO's forum on the impact of open course ware for higher education in developing countries for the first time used the term "Open Educational Resources".

In 2002 Carnegie Mellon University initiated Open Learning Initiative.

In 2005 Internet Archive in collaboration with yahoo, University of Toronto and University of California established an international network named the open content alliance.

In 2007 Open Society Initiative and Shuttleworth foundation convened a meeting in Cape town with an aim to stimulate the ideas regarding promotion of open resources, technology aid and teaching practice in education. The outcome came as a published report in 2008 famously known as Cape Town Open Education Declaration. In order to initiate dialogue and to help and improve open education movement's growth, this declaration contains three statements i) statement of principle, ii) statement of commitment and iii) the statement of strategy (*Cape Town Open Education Declaration – Unlocking the Promise of Open Educational Resources,* 2007).

In 2010 UNESCO and Commonwealth of Learning jointly initiated the project "Taking the open education resources beyond the OER community: policy and capacity".

"Commonwealth of Learning (CoL) has been working to promote the development and sharing of quality teaching and learning materials; and, in 2011 it became the first intergovernmental organisation to adopt an open licence policy (Miao et al., n.d.).

In 2012 in collaboration with UNESCO and with the financial support of the William and Flora Hewlett Foundation, COL played a key role in organising the World OER Congress in Paris. That Congress resulted in the OER Paris Declaration, which explicitly urged governments to release teaching, learning and research materials developed with public funds as OER" (Commonwealth of Learning, 2012).

In 2018, in honour of tenth anniversary of Cape Town Open Education declaration the forum created ten key directions to move forward in open education.

These ten directions popularly known as CPT+10 in brief is as mentioned below: -

i) Communicating Open

ii) Empowering the next generation

iii) Connecting with other open movements

iv) Open education for development

v) Open pedagogy

vi) Thinking outside the institution

vii) Data and analytics

viii) Beyond the textbook

ix) Opening up publicly funded resources

x) Copyright reform for education.

In November 2019, the 40th UNESCO General Conference adopted the UNESCO OER Recommendation which is the only international standard setting framework in this area worldwide (UNESCO & CoL, 2019).

3.3 CHARACTERISTICS OF OPEN EDUCATIONAL RESOURCES

The characteristics of the OERs are given below:

OERs are accessible free of cost. Although there may be some specific objectives to achieve that forced the countries, international organization, societies or educational institutions to initiate the OER projects, but the primary and basic objective behind all the initiatives is the free of cost availability of educational resources.

OERs are available with pre-approved licenses. The second important feature of open educational resources is the availability of the resources with open license which allows users to adapt, reuse and refurbish it. Most of the resources available in "Open Content" are with some restrictions, the users cannot use, reuse and recreate them due to copyright and intellectual property rights. Whereas OER are available with open license most of the open license are granted by creative commons license that allow teachers to customize them or recreate them according to their local learner's ability, language and culture by giving due acknowledgment to the original author.

Another important characteristic of OER is its adaptability. In current era, most of the users are equipped with electronic devices like mobile phones, tablets, laptops or desktops etc. but the access to high-speed internet is still not very common especially in the remote areas, villages, hilly areas or areas with special concerns like Jammu and Kashmir, etc. In such situations, users can download the open educational resources and use them as and when required later. Downloading facility is available in cases of Open licensed and without fees OERs only. The resources other than OERs legally or technically do not allow downloading or reusing of content due to license restrictions and subscription fees.

OERS make education affordable to everyone. As most of the prestigious educational institutions are putting their educational material free of cost and providing free

online course, available on their websites. It has made the educational content in reach for everyone. It is in line with United Nations Organization's (UNO) motto free education to all and education equality. It has benefitted the learning community at large. Those learners who could not join or attend the prestigious institutions like MIT, Harvard, Stanford, Rice etc due to their geographical, financial, physical or other limitations can now access the educational resources of these institutions freely and can update and sharpen their own educational skills.

OERs can reduced financial burdens: Another financial aspect which highly supports the importance of OER from students' perspective is the reduced financial burdens. OER and open textbooks can be easily accessed free of cost and that too in digital format it saves huge amount that students had to spent on purchase of textbooks, as photocopying charges or as high subscription fees.

OERs as supplementary reading material. OERs also acts as a supplementary reading material for teachers and learners both. The teaching and learning community can see, read, use and reuse the educational resources, tools and techniques used and adopted by other prestigious institutions. Such practices help teachers to take advantage and learn from other additional resources apart from their own primary reading materials. Teachers can get new ideas, inspirations and teaching aid from these supplementary educational materials. These additional resources help teachers to get better insight and knowledge on a specific subject. On the other hand, use of OERs as supplementary educational material helps student community in getting better grades and make them more updated and knowledgeable than other fellow classmates.

OERs provide equal access to quality education. Earlier the access to quality educational content was feasible to only those who get enrolled in educational institutions or to those who have enough funds to buy these educational materials. As OER content is available free of cost, so it has come within reach of those underprivileged sections of society who earlier could not afford to purchase these materials. OERs helps in achieving Universal equality of education and equal access to quality educational material.

OERs avoids duplication on the same topic/ subject area: Earlier teachers were not able to see the teaching materials of other colleagues or institutions. With open course work initiatives, now faculty members from different schools/ departments can see the teaching material of other teachers from different countries/ institutes. This can avoid overlapping or duplication of the same topics they cover. The study material produced by teaching community of some prestigious institutions can be used by other institutions teachers to cover the same topic. Availability of open educational resources also help academicians to change their overall teaching pedagogy, encourage them to adopt good educational practices and setting their own global benchmarks.

OERs deliver more refined and vast academic knowledge: Open educational resources help the students and teachers from low academic level or low ranked institutions to get access to quality content produced by other prestigious institutions and teachers. In this way open educational resources provide opportunity to the low ranked institutions, learners and teachers to get more authentic, reliable and knowledgeable content on the same subject or topic from prestigious teachers. Now teachers can easily see how the different institutes, teachers and disciplines approaches the same material. Such capabilities make it a richer experience for learners and teachers in generating new refined knowledge and many inter and intra departmental collaborations.

OERs are great asset for professional education and continuing education programs: The main feature of OER that delivers world class educational material free of cost available to all, facilitates in the development of skills and new knowledge creation that are required for the advancements in society. Open educational resources prove to be greater asset for advancements in professional education, continuing educational opportunities for distance learning, self-learning and also help the society in socio and economic mobility.

OERs provide universal homogenous quality education: Around the globe implausible disparity exists, due to economic and social imbalance which results in uneven resources, academicians and infrastructure availability. Open educational

resources provide an opportunity to remove these disparities and universally provide equal homogenous quality education to all.

3.4 SOURCES OF OER

There are many methods and sources available for delivering open educational resources. The most popular sources from where OERs can be accessed are mentioned below: -

a) Open Course Wares

MIT is the pioneer academic university that started the open course ware in 2001. There is a worldwide network of universities and educational institutions that offer open course wares. Many other universities are currently providing open courses such as Harvard, Stanford, Rice University etc.

b) Open Educational Consortiums

Open Educational Resources Consortium is a global network of worldwide community where hundreds of academic organizations, universities and higher educational institutions jointly share their resources, experts and research outputs for benefit of academic community at global level. Coursera, and Universia, EdX etc are such popular consortiums.

c) OER websites

Many non-profit organisation or private partners are also involved in helping the society by providing free and open educational resources. There are large number of such open educational resources' websites active both at national and international level. Such as in India Khan Academy and Rai Courseware, etc are the private open educational resources platform providing open education in interactive media without any cost.

d) OER Repositories

OER repositories are websites that collaborate and provide many OERs under one platform. These repositories contain open educational resources and their metadata

both, and manage these metadata through the repository website. The search of relevant open educational resource is made possible through its metadata. On the basis of their location OER repositories have been divided into three categories:

i) **Local Level OER Repository:** This type of repository manages the resources and metadata stored in its local repository.

ii) **External level Repository:** This type of repository facilitate access through OER websites and provide access to the resources and heterogeneous metadata that was stored in various external repositories.

iii) **Hybrid Repository:** This type of repository facilitates the access to local repository resources and external repository resources together at one place through its website.

e) OER Collaborations

Many organisations or institutions in collaborations with other organisations work together to meet the common objective of open educational resources. Many such initiates are supported by UNESCO, William and Flora Foundation, Creative Commons and European Commission etc. In India many such initiates are active with financial or other supports from Ministry of Human Resource Development (now Ministry of Education) or with support from IITs, IIMs and other universities.

f) OER Government Initiatives

The governments in many countries have agreed upon to put up all that educational material or research outcomes in public domain that have been completed with public money. Apart from this the governments in many countries have also initiated many projects and repository to put all the educational content free of cost for the poor and needy students. In India, NCERT textbooks is one such noble initiative of Government of India.

f) OER Educational Institutions

Many academic institutions at all levels of education whether primary, secondary or higher education are providing open educational resources. These academic

institutions have fostered the open educational resources movement that aims to provide equal access to knowledge for all the students.

Many Institutions are willingly participating in the OER movement as they feel it will improve their academic reputation and will help them in improving their research results and learning materials vide open sharing. Many academic universities and academic institutions have put up all their educational material like textbooks, course wares, case studies, project reports, etc. in public domain under Open educational resources for free use by all such as MIT, Stanford University, Rice University, etc.

3.5 KEY ROLE PLAYERS IN OER MOVEMENT

There are many key role players in the open educational resources movement that has stimulated and facilitated this noble movement to reach at global level from local level. These key role players have supported the open educational resources movement in many ways such as by providing technical support, financial aid, policy making, standardization and in promotion and awareness etc. In the coming section few of the such key role players are listed along with their activities and roles in open educational resources movement. Many philanthropic organisations like Mellon Foundation, UNESCO, Hewlett Foundation and Commonwealth of Learning etc have provided financial support to propel the OER movement worldwide.

a) UNESCO

UNESCO is United Nation's one and only agency that has a dedicated programmme on open educational resources. The credit of coining the term open educational resources also goes to UNESCO during its forum on open courseware in higher education in 2002.

UNESCO believes that "universal access to information through high quality education contributes to peace, sustainable social and economic development, and intercultural dialogue. OER provide a strategic opportunity to improve the quality of learning and knowledge sharing as well as improve policy dialogue, knowledge-sharing and capacity-building globally" (UNESCO, 2012).

Another important milestone related to open educational resources movement that UNESCO has in its credit is adoption of OER recommendations (UNESCO & CoL, 2019).

The Recommendation on OER - adopted unanimously by the UNESCO General Conference at its 40th session in November 2019 - supports the creation, use and adaptation of inclusive and quality OER, and facilitates international cooperation in this field.

The UNESCO OER recommendations are the only international standard framework available in OER area worldwide. The recommendation is the only existing international standard-setting instrument on OER and is the fruit of over a decade of efforts to bring together a wide diversity of stakeholders.

The Recommendation outlines five Areas of Action, namely:

i) Building the capacity of stakeholders to create, access, re-use, adapt and redistribute OER;

ii) Developing supportive policy for OER;

iii) Encouraging inclusive and equitable quality OER;

iv) Nurturing the creation of sustainability models for OER; and

v) Promoting and reinforcing international cooperation in OER.

b) Commonwealth of Learning

Commonwealth of learning was established as an intergovernmental organisation with a mission "to promote the development and sharing of open learning and distance education, resources and technologies" (Commonwealth of Learning., 2000). COL is hosted by Canada and its headquarter at British Columbia and regional office at New Delhi. COL is the only International and Intergovernmental organisation that promotes the development of distance education and open learning. In all 53 countries are member of commonwealth. COL has done milestone activities in advocating the use and development of OER at global level. Some of the key achievements of COL are mentioned below:

i) In 2012 UNESCO and Col in collaboration organised a consultation series where government departments were invited to provide information about policies related to OER.

ii) COL in Collaboration with Government of Slovenia conducted two global level surveys. The results of these surveys highlighted the several gaps and challenges in the development and implementation of OER. The survey findings were published as the Global OER report 2017.

iii) In 2016-2017 CoL hosted six regional forums around the world for the OER studies. The findings of this study were summarised in a book "Open educational Resources: from commitment to action"

iv) COL and UNESCO in collaboration organised the 2nd world OER congress in 2017 at Slovenia. "OER action plan" was formulated in this event which aims to mainstream OER for achieving equitable quality education, capacity building, improve knowledge sharing and to achieve universal access to quality learning and teaching resources by 2030(*Commonwealth of Learning - Learning for Sustainable Development*, n.d.).

v) COL organised first world open educational resources congress in Paris. The landmark Paris OER declaration is the outcome of this event which inspire govt that all educational material developed with public funds should be available with public license.

vi) In 2019 COL and UNESCO in a joint venture released "Guidelines on the development of open educational resources policies". It is a specific tool to analyse the current policy status and help in understand the copyright and Licensing/alignment policy (UNESCO & CoL, 2019).

vii) In 2020 COL in collaboration with UNESCO organised a series of workshops on capacity building. The workshop objectives were to provide awareness about OER policy, to facilitate in OER capacity building, to provide support in the development of OER policy, and to monitor the impact of OER recommendations implementation (Commonwealth of Learning, 2012).

c) SPARC

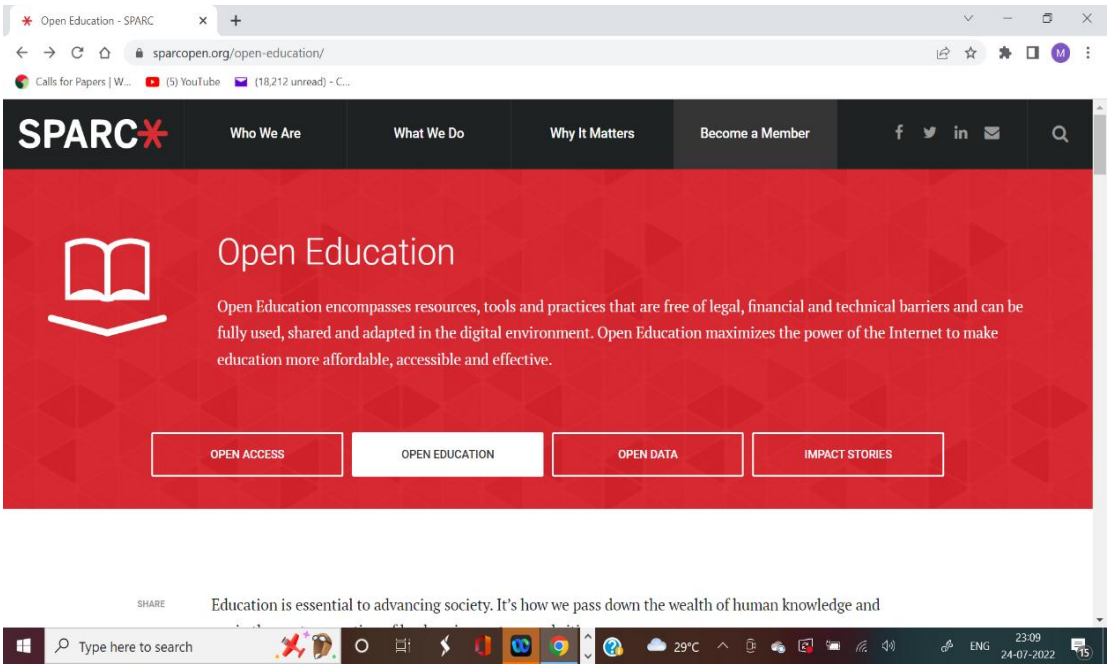

Figure 3.1: SPARC Homepage (Source: www.sparcopen.org)

The acronym SPARC stands for the Scholarly Publishing and Academic Resource Coalition. SPARC collaborates with authors, libraries, students, publishers, financial supporters and policy makers. The primary objective of SPARC is to promote open sharing of educational material and research output so that knowledge can be equally accessible. SPARC "works to create a world in which anyone can access, build upon, translate, and improve knowledge. Students should have access to their learning materials and teachers should be able to update, improve, and customize resources with ease. Researchers should be able to read any article and its supporting data without having to negotiate, they should be able to use text and data mining tools that have the potential to optimize their results. SPARC has different international chapters namely SPARC Europe, SPARC Japan and SPARC Africa. It has around 600 libraries and Academic institutions as global partners. Around 240+ Research and academic libraries of Canada and USA actively work together with SPARC to promote open access of scholarly article, open sharing of research data, and above all creating and adapting open educational resources by member libraries. From the past few decades, SPARC has promoted research and education at global level by its Open Content plan and its three major parts (i) Open Access, (ii) Open Data, and (iii)

Open Education Policies and Practices. SPARC has actively advocated the inclusion of Affordable College Textbook Act in sec 133 of Higher Education Act. Higher Education Act is one of the important legal avenues for promotion and use of OERs at higher educational institutions in Europe (*Open Education - SPARC*, 2017).

d) OE Global

OE Global was launched in 2008 at Massachusetts. Initially it was set up as an open courseware and was popularly known as Open Courseware Consortium.

In 2014 due to broader vision and expansion from open course ware to Open Education it was renamed as Open Education Consortium.

In 2019 the members again reformed the strategies and priorities and advocated global perspective on open education so the new name to the forum came as Open Education Global.

OE Global is one of the largest open educational resource's networks now. Around 243 universities and institutions from 44 countries are partner in this initiative and are providing open educational resources in 29 different languages.

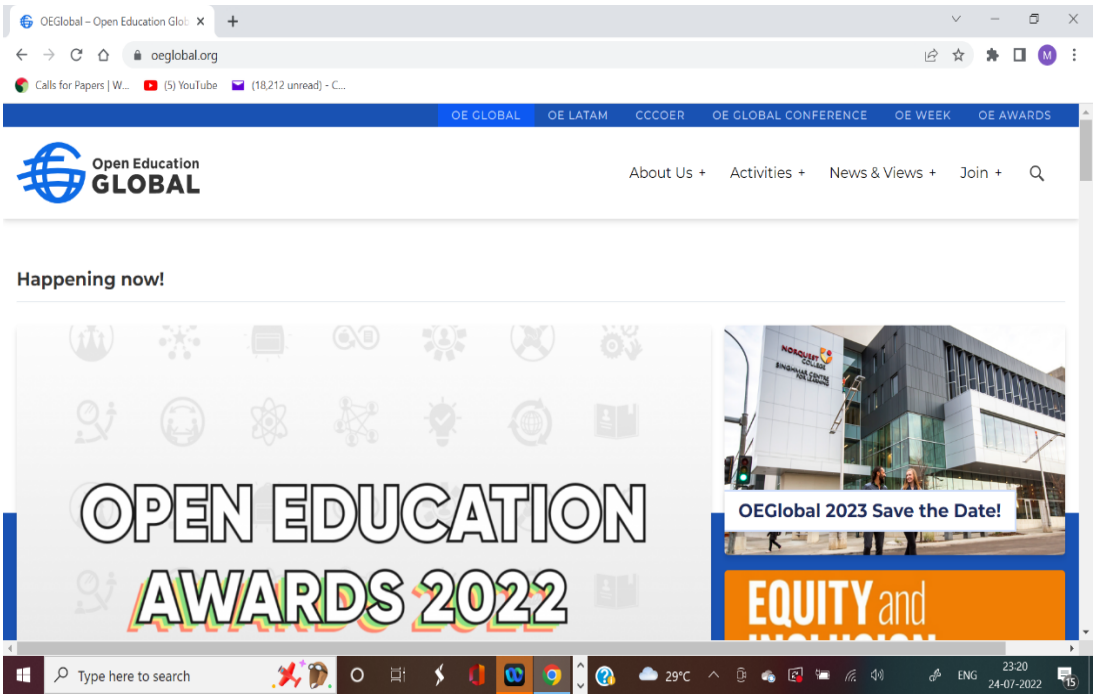

Figure 3.2: OE Global Homepage (Source: www.oeglobal.org)

OE Global is an international level member based non-profit organisation that support the world in development and use of open education. The mission statement of OE Global contains " a) expand access to education enabling every person on earth to access and contribute, b) improve the quality of education, c) make education more affordable, d)improve student success, e)foster collaboration and sharing through co-creation of education materials and the freedom to use, customize, improve and redistribute them, f)generate pedagogical innovation using the collaborative, interactive culture of the Internet, g) foster international partnerships and a global participatory culture of learning, creating, sharing and cooperation"

OE Global in collaboration with other organisations actively participates in creation and promotion of Open Education movement. Since 2013 every year in March it organises Open Education Week to raise awareness and to rejoice the impact of open education at global level on teaching and learning.

OE Global also organises annual OE Global Conference. It is one of the exclusive international conferences on open education with a prime motive to improve access, participation and success in open education.

OE Global also gives recognition to outstanding contributors in open education. OE Global Open Education Award for Excellence is given annually in two categories Individual and Research tool and practice award (*OEGlobal – Open Education Global*, n.d.).

e) MOOCS

The open education and open educational resources movement created a pathway for the open online courses popularly known as MOOCs. MOOCS stands for Massive Open Online Courses. The circuits and electronic course by MIT was the first ever MOOC Course. Later many other universities also started offering free online courses such as University of Manitoba, Canada and Boston University, USA offered free course on Digital Product Management. At present a large number of universities are offering their courses on MOOCs, and since 2015 learners can also earn academic credits for MOOC course on EdX.

Powell (2013) has mentioned that “the rapid proliferation of MOOCs has forced the higher education institutions to recognise the strategic importance of online learning and open education”.

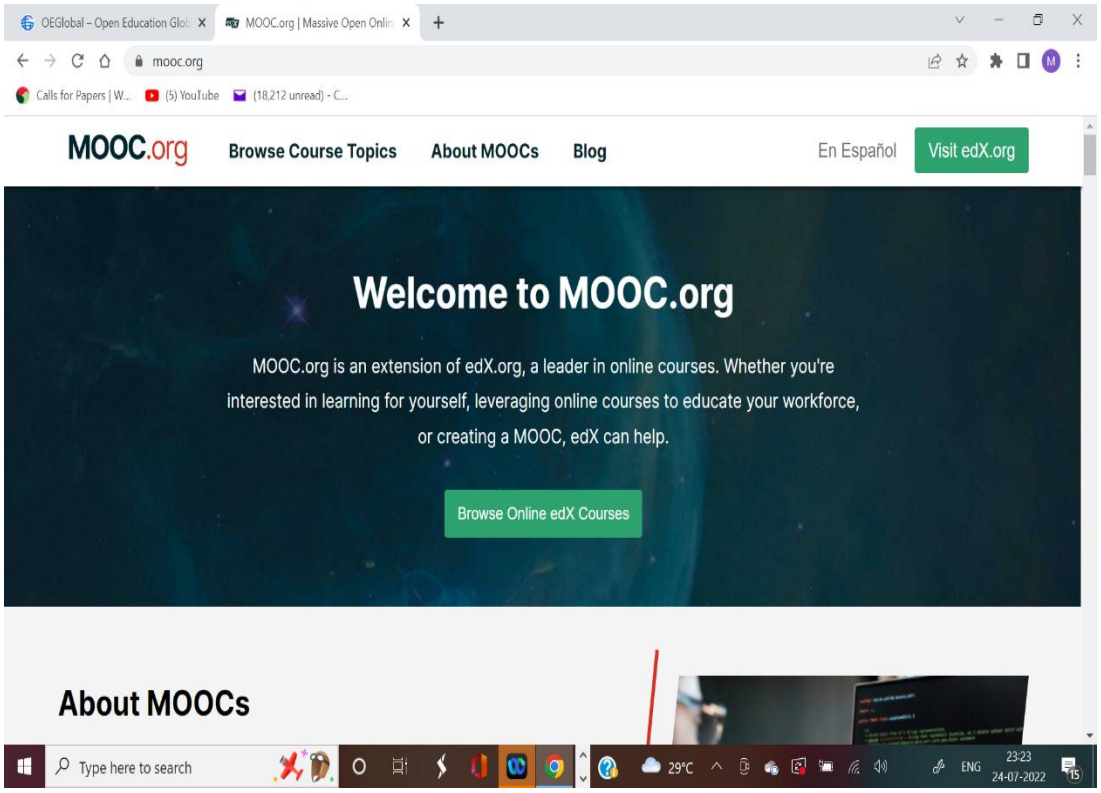

Figure 3.3 : MOOC Homepage (Source: www.mooc.org)

In the words of Mcauley et al. (2010) “MOOC integrates the connectivity of social networking, the facilitation of an acknowledged expert in a field of study, and a collection of freely accessible online resources”.

Three MOOC models as broadly categorised by (Siemens, 2013) are:

cMOOC: cMOOC are the online courses that are led by the principles of pedagogic innovations in a richly networked and disaggregated mode of social learning.

xMOOC: xMOOC that are massive, institutionally driven and content focused courses that are based of pedagogical models of university.

QuasiMOOC: Quasi MOOCS consists of open educational resources are loosely connected resources provided to learners for specific tasks.

f) Creative Commons

Creative common is a US based non-profit organisation. Creative Commons was founded by Lawrence Lessig, Eric Eldered and Hal Abelson in 2001. Creative Commons is a global network with an aim to provide educational access and to expand the range of various available creative works to others for use, reuse, reconstruct and reshare them legally. Creative Commons release several copyright licenses free of charge and these licences are popularly known as Creative Commons Licenses. This Creative Commons licenses allow the authors to convey which right they want to reserve and which right they want to waive off and share in public domain for the benefit of society, learners and for other creators. A Creative Commons license provides a flexibility to authors where the author can select to allow copyright for the non-commercial use only to protect it from copyright infringement and further distribution of work (CCL, 2019).

Creative Commons license are available in many types of license rights out of which seven licenses are the most frequently used licenses that include.

- Attribution Alone
- Attribution and share alike
- Attribution + Non-Commercial
- Attribution + Non-Commercial + share alike
- Attribution+ No derivatives
- Attribution + No derivatives + Non commercial
- Freeing content globally without any restrictions.

Figure 3.4: Creative Commons License Rights (*Verify Your Open Licensing Prowess with Creative Commons Certification | Opensource.Com*, n.d.)

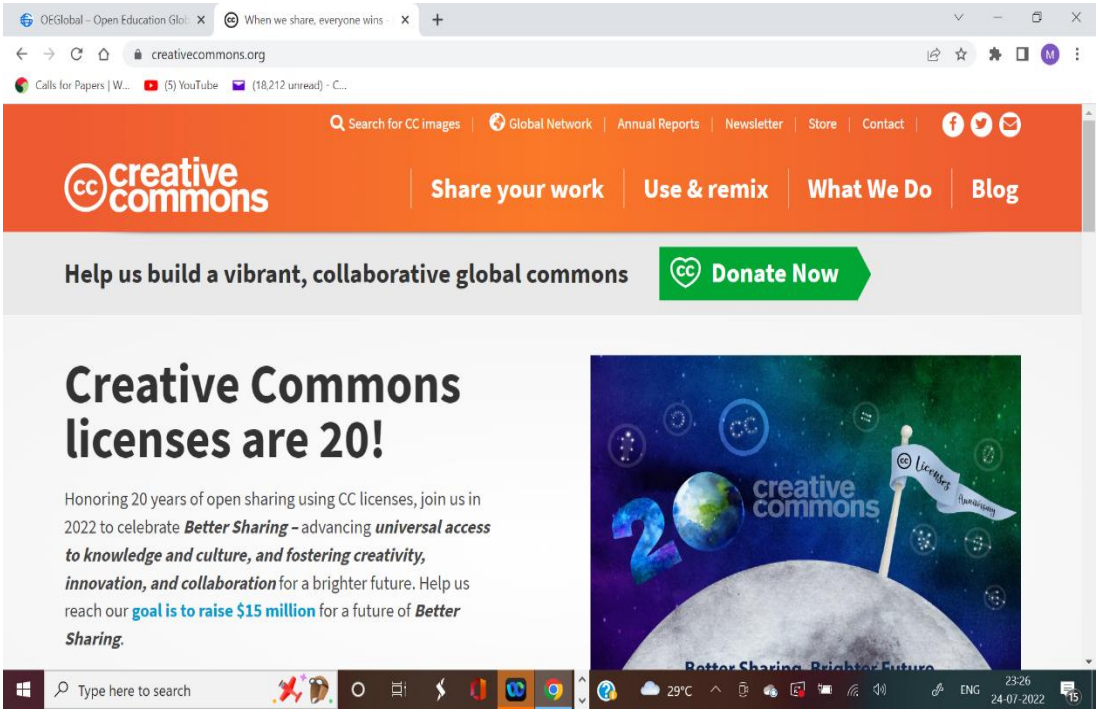

Figure 3.5: Creative Commons Homepage (Source: www.creativecommons.org)

All these creative commons license rights are denoted with symbols which conveys the users about the rights and restrictions (CCL, 2019). Creative Commons has played significant role in promotion and effective utilisation of open education resources. Due to Creative Commons licenses availability many universities / institutions/ authors can share their coursework, textbooks, and study material etc. in public domain that has further facilitated its adoption and customisation keeping in mind particular learner need and requirements.

g) Open Learn

Open Learn is a free based learning platform. It was launched by Open University in 2006. Open Learn provides hundreds of free educational resources which along with full courses also provide articles, videos, games, features and many more open learning resources. The subject fields that Open Learn covers for providing free full courses are from arts to forensic and many more (Open Learn, 2019).

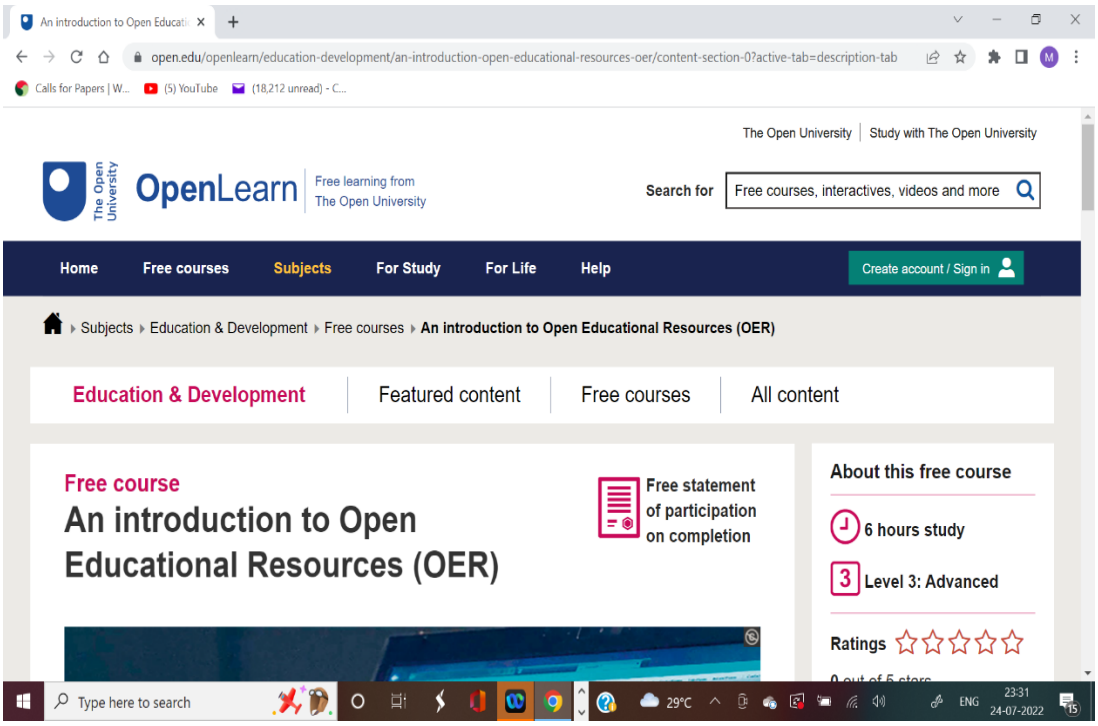

Figure 3.6: Open Learn Homepage (Source: www.open.edu)

The academic content delivered by Open Learn includes; - 950+ short courses, hundreds of audio/video content starting from Greek history to current political

scenario and everything in between the both. It also includes thousands of puzzles, articles, quizzes and interactive games.

Open Learn also provides printed content produced by Open Learn and BBC together for many TV and Radio programmes. Open learn is a big name in open educational resources and has many prestigious awards in its credit in the field of open education. All the educational content provided by open learn is provided with creative commons licensing and can be reused, remixed and redistributed.

h) Connexions to OpenStax

Connexions is a digital education system that contains open-source content management system that facilitates the delivery of open educational resources and open access learning object repository.

Connexions is among one of the most famous open educational resources web platforms in the world. This repository has a large collection of about 17000+ learning object and thousands of open textbooks, research articles, etc.

The Connexions website is most widely used open educational resources website in the world and about 2 million people every month use and visit connexions repository. The educational content is available for learners of all ages whether primary or PG level and it also provides educational content in all disciplines whether it is Mathematics, Science, History, English or Psychology and many more.

The educational content on connexions is available with easily downloadable format and can be used on any mobile device along with online open educational resources. Connexions also facilitates schools by providing hard copy of textbooks at very low cost.

Connexions was founded in 1999 by Dr Richard Baraniuk at Rice University, USA. Later it was renamed as Open Stax and currently it is known as Open Stax CNX (Baraniuk, 2008).

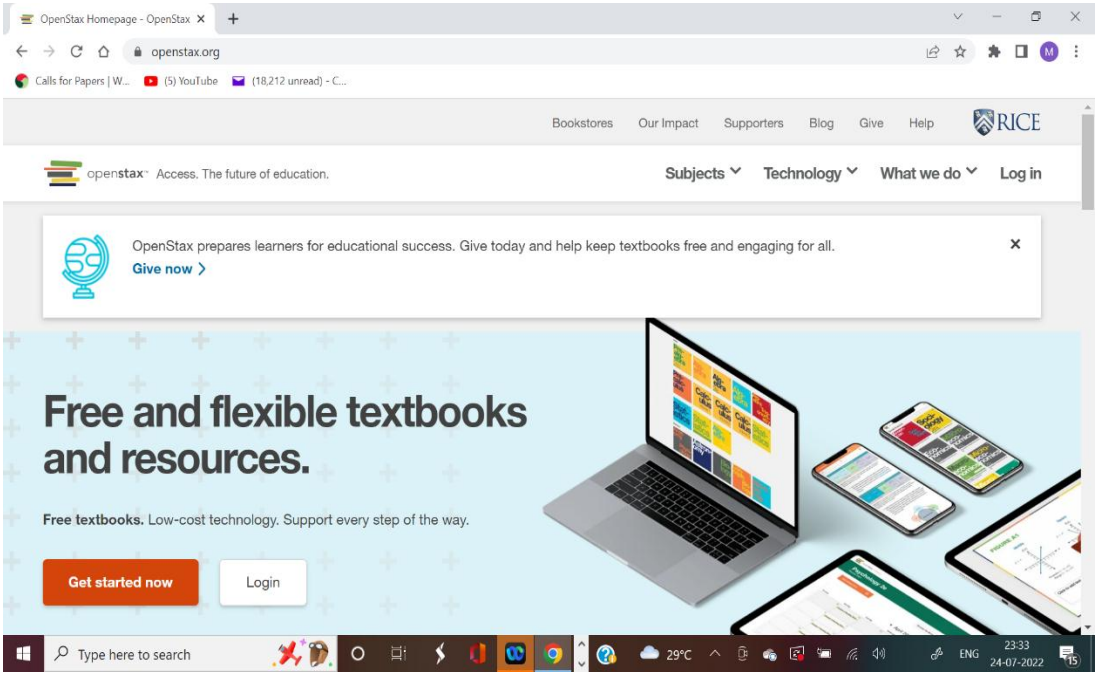

Figure 3.7 : Open Stax Homepage (Source: www.openstax.org)

Open Stax CNX is a non-profit dynamic digital learning system that delivers free educational content to millions of users per month.

Open Stax is designed in such a way that it encourages sharing and reuse of educational material. All the contents on open Stax are created in semantic HTML format which makes it easily adaptable at anywhere.

Moreover, from legal aspect all the open stax contents are available with Creative Commons license so authors can use and reuse it legally. This project is financially supported by William and Flora Hewlett Foundation and by many other organisations.

i) MERLOT

The project begun at the California State University in the year 1997. MERLOT acronym stands for Multimedia Educational Resources for learning and Teaching.

The collection of Merlot contains 91000 educational materials in 22 different languages and in 22 different types of materials. That includes case studies, online courses, learning object repository, assignments, etc.

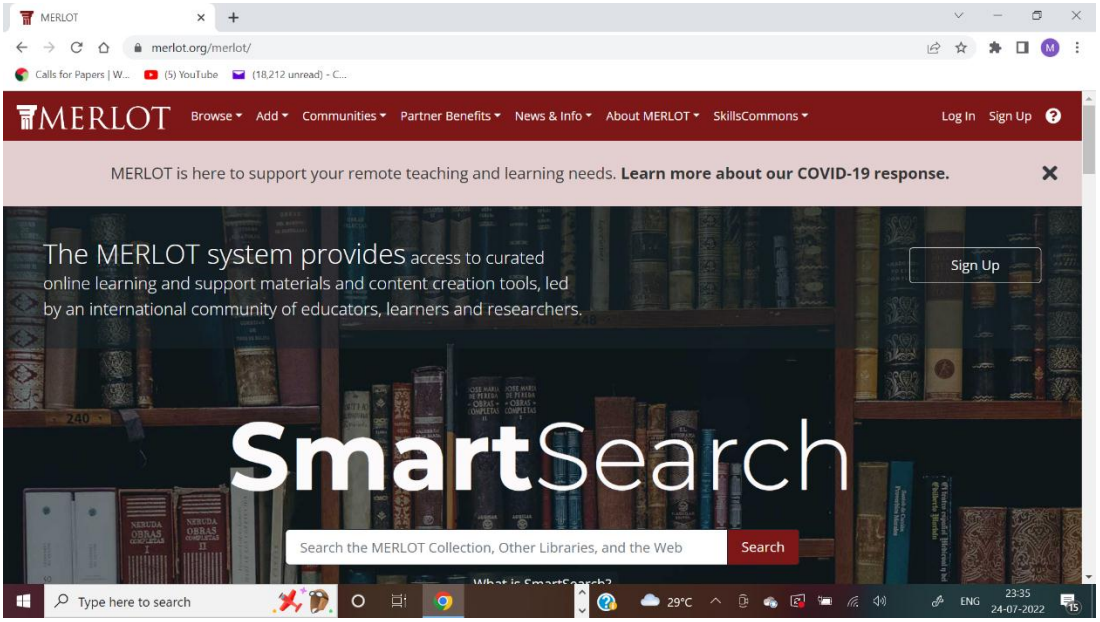

Figure 3.8: Merlot Homepage (Source: www.merlot.org)

Merlot is a very valuable online portal for any requirements related to open educational resources. Membership to Merlot is free.

Merlot encourages its members to review and rate the open educational resources so that other users can search and select open educational resources on the basis of this rating and review (Rutledge et al., 2001).

Merlot also supports advanced search options which help the users to narrow down their particular search. The resources can be searched on the basis of keywords, languages, title, type of material, format of material, peer-reviewed material, copy righted material and many other options.

Merlot has robust search system, moreover users can search by the ISBN number and can also find out the related available book or content.

j) OER Commons

ISKME launched OER Commons in 2007. OER Commons is a digital public library that provides high quality OER and also offers vast infrastructure and expert academicians that collaborate together in adaption, evaluation and usage of OERs and also cater to the needs of teachers and students (ISKME, 2007).

OER commons is a single point search to all open educational resources that has a growing collection of 50000+ high quality open educational resources that includes full courses at university level, open textbooks, K-12 level lessons, activities, worksheets, interactive minilessons and simulations, etc.

OER Commons hosts vast learning resources in many subject areas such as applied science (7964), life science (7787), arts and humanities (6193), physical science (6130), education (4907), social science (4709).

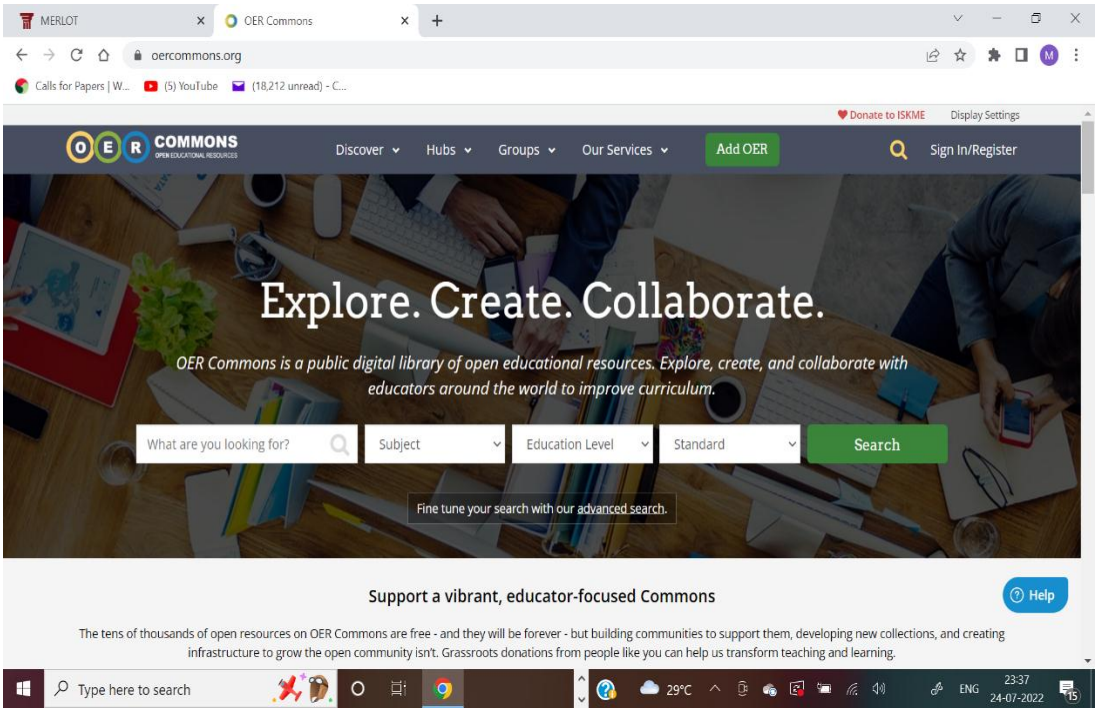

Figure 3.9: OER Commons Homepage (Source: www.oercommons.org)

k) Digital Commons Network

The digital commons network is a gateway that provides free access to millions of full text scholarly articles and other open educational resources from hundreds of colleges and universities all over the world. The collection of digital commons consists of 3952975 works from 642 college and universities.

The Digital Commons under their institution repository provides an opportunity to authors, faculty, researcher and librarians to contribute and deposit their scholarly work in their free and worldwide accessible institutional repository (Bepress, 2015).

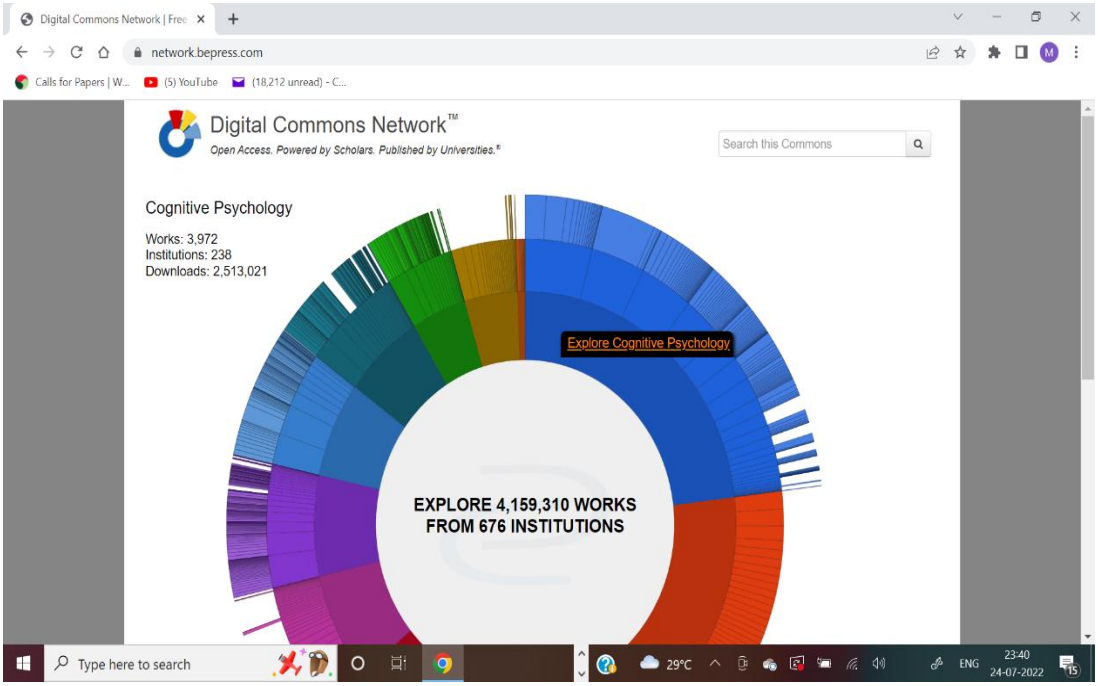

Figure 3.10: Digital Commons Homepage (Source: www.network.bepress.com)

l) Open Edu Framework

This "Open Edu Framework" was designed by European commission as a support framework for higher education institutions. This Open Edu project is one of the 6 priorities of European Commission listed under E&T 2020 priority list (queromi, 2016). This priority states that "Open and Innovative education and training" by fully embracing the digital era. This priority further states the opening up of education as an innovative teaching and learning for all through open education resources and through new technologies. The Joint Research Centre (JRC) a division of European Commission supports this opening up education project. JRC analysed those various factors like quality, efficiency, equity and innovations are influencing the adoption of Open EduProject. Hence, JRC released Open Education framework for higher education. This framework was designed to support the European higher education institutions to make various strategic decisions regarding open education. The framework is a hands-on tool with 10 dimensions of open education. The first six dimensions are the core dimensions which include access, content, pedagogy, recognition, collaboration, technology and research and the rest four are transversal dimensions which includes: strategy, leadership, technology and quality.

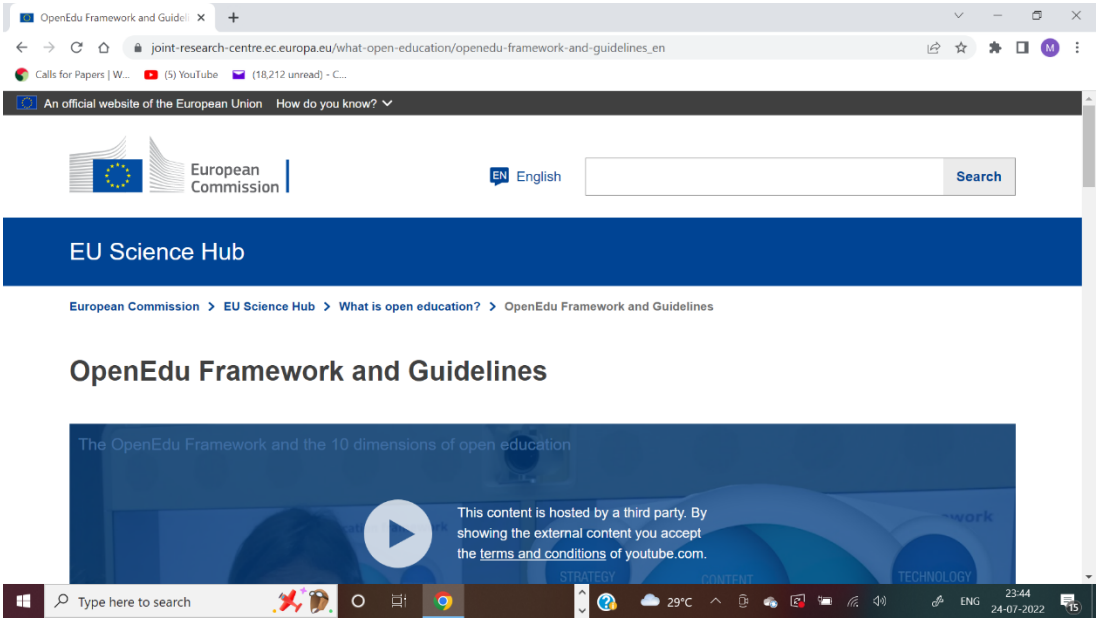

Figure 3.11: Open Edu Framework Homepage

3.6 OER INITIATIVES IN INDIA

Indian prime minister appointed National Knowledge Commission in 2005 with an objective to bring excellence in Indian educational system. Dr Sam Pitroda, the chairman of the National Knowledge Commission intended to transform Indian education sector. In 2007 National Knowledge Commission with the financial support from government and other funding agencies initiated National e-content and curriculum initiative including National Digital Library (*National Digital Library of India*, n.d.).

The report of National Knowledge Commission has mentioned that "Our success in the knowledge community economy hinges to a large extent on upgrading the quality of, and enhancing the access to education. One of the most effective ways of achieving this would be to stimulate the development and dissemination of quality Open Access (OA) materials and Open Educational Resources (OER) through broadband internet connectivity" (*National Knowledge Commission Report to the Nation 2007 Government of India*, n.d.).

India is a leading and active role player in various open access initiatives, whether it is Open-Source Software movement or Open Access of Journal Movement or Open

access repositories. There is increasing availability of open content in terms of open access journals, open access repositories and other open source softwares repositories like Eprints, Fedora and Dspace etc. Open Educational resources in higher education are very less as compared to open access scenario.

"The Indian government has played a proactive role by providing impetus to the growth of OER movement in the country through various national policy initiatives. A number of meaningful initiatives are being taken up to embed the OERs into the educational environments of today by Indian universities" (Thomas, 2017).

Some well-known Open Access Initiatives that made significant contribution in the expansion and success of OERs in India are mentioned below.

a) NPTEL

NPTEL acronym which stands for National programme on technology enhanced learning is largest online repository in engineering, humanities and basic sciences etc courses at global level. In 2003 seven premier IITs of India (Delhi, Bombay, Kanpur, Madras, Kharagpur, Roorkee and Guwahati) in collaboration with IISc Indian Institute of Science initiated NPTEL program. This program was funded by Ministry of Human Resource development (now Ministry of Education), Government of India (*Nptel, Online Courses and Certification, Learn for Free*, n.d.).

NPTEL is one of the most successful OER project. NPTEL YouTube channel has more than 42+ lakh subscriber and has over 1 billion viewers. It is one of the most accessed peer-reviewed educational content library in the world. NPTEL resources consists of video content of 56000 hours, transcribed content of 52000+ hours and subtitled videos of 51000+ hours. NPTEL has partnership with colleges also and under NPTEL local chapter 4200+ colleges are partner in this (Kumbar, n.d.).

To help the regional language students NPTEL also provides translation of video courses in 10 regional languages. The journey of NPTEL is mainly divided into three phases.

In first phase (2003- 2008) five core disciplines civil, computer science, electrical, electronics & communication and mechanical engineering were identified. During this phase 235 courses were developed in web/video format.

In second phase (2009-2014) NPTEL included core science courses also in addition to engineering courses to cover the undergraduate and post graduate courses in engineering, management and physical science course NPTEL created additional 600 web and video courses. It also made several improvements in this phase and included indexing of all videos and keywords search facility for all the courses were also added.

In third and ongoing phase (2014 onwards), NPTEL also started offering MOOCs open online courses with certification from IITs and IISc. Currently, total 522 courses are being offered. All these certificated courses are freely available but if participant want a certificate, then a nominal fee is charged from the participant. All the materials are offered under creative commons license. Detailed guidelines by UGC, AICTE for Credit transfer of these courses are also available.

b) SWAYAM

In order to achieve education policy's three cardinal principles i.e access, equity and quality, Government of India initiated a program called SWAYAM. It is a platform that provide interactive courses free of cost to be accessed anywhere anytime by students of class nine to post graduation level. SWAYAM host courses in four quadrants i) Video lectures, ii) Reading materials (downloadable/ Printable) iii) test and quizzes for self-assessment and iv) online discussion forum. The ministry of Education, NPTEL, IIT Madras and Google are helping in the development and management of SWAYAM platform (Swayam Central, 2017).

SWAYAM uses state of the art technology and uses audio/visual and multimedia technology to enrich the learning experience. AICTE, UGC, NCERT, NIOS, IGNOU, NITTTR, IIM Bombay and CEC are nine national coordinators of SWAYAM. Like NPTEL, SWAYAM also offers free of cost courses and charges a nominal fee if SWAYAM Course certification is required.

Both UGC and AICTE have issued regulations where credits can be transferred to student's academic record if he/she has done any course through SWAYAM platform (*Swayam Central*, n.d.).

c) NIOS

In 1989 Ministry of Human Resource Development (Currently known as Ministry of Education) Government of India initiated National Open School. NIOS offers open and distance learning programs for 10^{th}, 12^{th} and vocational courses. It is one of the largest open schooling systems in the world. 42 courses on different subjects are offered by NIOS on SWAYAM platform. NIOS has provided training to 13 lakh elementary teachers using Swayam platform (NIOS, n.d.).

d) NCERT

In 1961 Government of India set up an autonomous organisation named NCERT (National Council of Educational Research and Training) for quality improvement in school education. It has now been upgraded to a university. The objective of this organisation is to support and guide the state and central governments about various policies and programs related to school education. NCERT has played an important role in achieving the OER objectives at national level. Publishing model textbooks, journals, multimedia digital material, supplementary material and educational kits, etc.is the core objective of NCERT. In 2010 an act was passed in parliament with a resolution: "Right of children to free and compulsory education, 2010". It is one of the landmark resolutions and NCERT has played a proactive role in unfolding this national agenda. The publication of educational material very well meets the national agenda for promoting an equitable and universal access to education. NCERT has published 246+ textbooks for class 1 to 12. All these textbooks are freely available Open Educational E Resources. The NCERT had made provisions to access the books with QR codes and entire books can be downloaded freely however republication of these textbooks is strictly prohibited. NCERT has fulfilled the objective of OER in true spirit (*NCERT*, n.d.).

e) NROER

National Repository of Open Educational Resources is a collaborative platform that was initiated by Ministry of Human Resource Development (currently known as Ministry of Education), Government of India. The repository is jointly managed by NCERT and Central Institute of Education and Technology (CIET). The Centre for Cultural Resources and Training (CCRT), UNICEF, Azim Premji University, Vigyan Prasar etc. are the partners of NROER.

It is one of the largest repositories that has 700 collections and total 19700+ resources out of which 5934 are text resources, 1453 are interactive resources, 2956 are audio resources, 2582 images and 6842 videos in its collection. Majority of resources are in English languages i.e 13180 out of total 19767. It also has 440 textbooks in its collection (*ICT: ABOUT NROER*, n.d.).

f) National Digital Library

National Mission on education through information and communication technology (NMEICT) and Ministry of Education funded and sponsored the National Digital Library of India. The National Digital Library (NDL) is developed, maintained, and operated from IIT, Kharagpur (*National Digital Library of India*, n.d.). It is a single window platform for learners to the largest virtual repository. It provides filtered and federated search engines that makes searching of required content easy and quickly. The repository has 72,234,634 number of resources and it keep on adding more material on daily basis. The resources are available in many languages. The repository contains all types of learning resources like articles, audio lectures, books, question papers, thesis and video lectures etc.

g) CEC (Learning Object Repository of the Consortium for Educational Communication)

The Centre for Educational Communication commonly known as CEC is an inter university centre set up by University Grants Commission (UGC). CEC was set up with an objective to address the needs of higher education institutes through a powerful medium and use of television and ICT for the information dissemination. In

the year 1984, UGC started the countrywide classroom programmes to disseminate educational knowledge through television. The production of such programmes took place at 21 media centres established in different Indian universities (*Oer | Consortium For Educational Communication*, n.d.). CEC is a nodal agency that coordinates, guides and facilitates these media centres about educational content production at national level. The CEC extended its dissemination strategy and started production of broadcast as well as audio visual and web based and related supported material. The web portal of CEC hosts many educational channels, you tube channels, MOOCS and Open educational resources.

h) National Science Digital Library

National Science Digital Library (NSDL) is an initiative of CSIR-NISCAIR (National Institute of Science Communication and Information Resources). NSDL provides high quality online open educational resources in engineering, science and technology and mathematics. Most of the resources on NSDL library portal are open educational resources and freely accessible to everyone with some exceptions to some of the resources that requires membership or fee (NSDL | NSDL, n.d.). The types of resources on NSDL portal includes case studies, lecture notes, interactive learning objects, full course materials, textbooks, lab activities and many more educational resources. The number of educational resources as per subject areas are such as Physical science (10123), Applied Sciences (7804), Education (5666), Life Sciences (7611), Mathematics (4835) and History (903).

i) E-Gyankosh

Indira Gandhi National Open University (IGNOU) in 2005 launched its popular open educational resources portal names as e-Gyankosh. It is a national digital repository that supports in storing, indexing, preserving, disseminating and sharing of digital content and digital learning resources that are developed by various open and distance learning institutes of India (*EGyanKosh: Home*, n.d.). The e-Gyankosh repository contains self-study print and online material for about 227 courses that comprises 40000+ course modules. More than 3000+ video programmes of IGNOU had also been digitised and uploaded on e-Gyankosh repository.

j) Vidhya Nidhi

The Government of India, erstwhile NISSAT and DSIR together started a pilot project in the year 2000 with an objective to make an e-thesis repository of India. With the support provided from Microsoft India and Ford Foundation Vidhya Nidhi became a national initiative. Microsoft India supported Vidhya Nidhi regrading implementation of Unicode for the different Indian languages (*Vidyanidhi - India's Educational News Portal*, n.d.). The Ford Foundation supported Vidhya Nidhi specifically on the project related to Ph. D theses in social sciences and humanities. Vidhya Nidhi is also a member of global initiative of Networked Digital Library of Theses and Dissertations (NDLTD). Similar to NDTLD project Vidhya Nidhi is also a member of UNESCO's supported project on Electronic Thesis and Dissertations. The mission statement of Vidhya Nidhi evolves to be a national repository and consortium for online resources and Indian Thesis.

k) Khan Academy

Khan Academy is a very popular private non-profit organisation that aims to provide world class education to anyone anywhere at free cost. The content at Khan Academy is created by world class expert professional teachers. Khan academy hosts educational content in interactive video formats and has educational content for all subjects available for class 1 to class 12 students (*Khan Academy | Free Online Courses, Lessons & Practice*, n.d.).

l) ePathshala

Since the introduction of digital India campaign, Indian education sector has witnessed extensive and effective usage of ICT in teaching learning process. Ministry of Education, NCERT and Govt of India jointly initiated the ePathshala Project. This portal is used to showcase and disseminate variety of educational and digital resources such as textbooks, images, audio-video, proceedings, periodicals etc.

The ePathshala is designed to achieve the equitable, quality, inclusive education and lifelong learning for all and bridging the digital divide. Teachers, Educators, Parents and Students can access e-books through web portals, through laptops, mobile

phones, tablets and desktops, and through multiple technology platforms etc. ePathshala also allows users to carry as many books as their device supports. Features of these books allow users to select, zoom, bookmark, highlight, navigate, share, listen to text using text to speech (TTS) apps and make notes digitally (*Epathshala | Learning On The Go*, n.d.)

m) E Grid

E Grid is developed by Indian Institute of Information Technology and management, Kerala for establishment of a virtual learning environment that aims to enhance the quality of education in Kerala. This project is supported by ministry of education. This project helps in hosting and distribution of NPTEL content and it also assist colleges in Kerala in establishing the infrastructure necessary for practicing the technology enabled learning. Presently open educational resources in science and technology are being offered by E-Grid.

n) Eklavya (OSCAR)

In the year 2004, IIT Bombay in collaboration with National Mission for Education through Information and Communication Technology (NME-ICT) initiated an interactive platform for creation of, absorption of, usage, and dissemination of knowledge content. This project was sponsored by Ministry of Human Resource Development presently known as Ministry of Education. The project Eklavya is an open sources project and manifested in various programmes such as e-Content, e-Guru and e-Outreach (*NGO For Children - Eklavya | Eklavya Children Books, Toys & Kits*, n.d.). The open-source courseware animations repository (OSCAR) project is a part of e-Outreach programme and creates a large repository of subject related interactive animation videos that helps in teaching various concepts and technologies in audio visual mode (*OSCAR Main Page*, n.d.). This project has opened up many new dimensions by providing opportunities in affordable classroom teaching and in self and distance learning. The web based interactive learning projects hosted on Oscar platform are offered in various subjects and topics at post graduate and under graduate level. It has around 500 learning objects available at UG and PG level and around 200 learning objects are available at school level. All the materials produced

under OSCAR project are in open-source courseware and all the learning objects are released under creative commons license.

3.7 OER INITIATIVES IN OTHER COUNTRIES

In many parts of the world open educational resources initiatives are active, few of them are mentioned below:

a) Open Data Project

Open data is a pilot project of Canadian Government that provides open government license just like creative commons license that allow the remixing and reuse for non-commercial purpose (*Open Data | Open Government, Government of Canada*, n.d.).

b) CANARIE

CANARIE stands for Canadian Network for Advancement of Research, Industry and Education. It is a federally funded corporation that develops open science, open data, enable open access, open publishing and creation of open educational resources in easily accessible formats (*CANARIE*, n.d.).

c) Tri Agency Open Access Policy

With a common objective to support the open access of scholarly publications three research funding agencies in Canada i.e., Natural Sciences and Engineering Research Council (NSERC), Canadian Institute of Health Research (CIHR) and Social Sciences and Humanities Research Council (SSHRC) agreed on a joint OER policy. The policy supports knowledge sharing, research collaboration and open access to provide free exchange of knowledge at national and international level (*Tri-Agency Open Access Policy on Publications - Science.Gc.Ca*, n.d.).

d) OER Universities Consortium

Open educational resources universities consortium is a global consortium where many universities from five continents in collaboration provides free online university courses. This consortium helps the post-secondary learners by providing free of cost educational material and also provide a pathway in achieving formal credible credentials.

e) Open Textbook Project of BC Campus

Ministry of Advanced Education, Innovation and Technology in British Columbia, Canada supported and implemented open textbook project for promotion of open educational resources concept. This project is providing more than 60 textbooks of post-secondary level as a support to OER open textbook initiative. BC Campus also hosts a working forum on open educational resources and also has a shareable online learning resources repository. This repository enables the licensing contribution and also provides free access to online teaching and learning resources (*Find Open Textbooks – BCcampus OpenEd Resources*, n.d.).

f) Thompson River University

Thompson River University's distance education wing called Thompson River University Open Learning provides prototype courses as OER. This university has a full fledge PLAR system that facilitate the credit transfers and makes Thompson River university a key partner for national and international OER initiatives (*Open Education Resource Projects: Intellectual Property Office: Thompson Rivers University*, n.d.).

g) Athabasca University

This university is a key role player in OER initiatives and was the first Canadian university to enter into open courseware consortium. This university is a house to many OER projects like OER Knowledge cloud, TEKRI (Technology enabled knowledge research institute), OER research website and Open education consortium website (*OER | Athabasca University Library & Scholarly Resources*, n.d.).

h) IDRC (Inclusive Design Research Centre)

IDRC is a research and development centre of OCAD University in Ontario, Canada. This centre promotes open educational practice at global level. All the learning technologies and products developed by IDRC are provided with general public license, which means the code is open source and enable users its free and liberal sharing and usage (*Inclusive Design Research Centre*, n.d.).

i) Flexible Learning for Open Education (FLOE)

It is one of the biggest OER initiatives. This project is funded by European Commission and Hewlett Foundation. FLOE creates various services and tools for OER delivery. The vision of FLOE is to cover broad international areas and to make education accessible to all. Keeping in mind some particular country's demand such as Africa where internet access is limited in such countries OERs are provided in text messages, audio formats and in formats that are visible on small mobile phone screens (*Supporting Diverse Learners and Educators | FLOE*, n.d.).

j) SPARC Europe

The acronym SPARC stands for the Scholarly Publishing and Academic Resource Coalition. SPARC was founded in 1997 in USA and its further extension SPARC Europe was founded in the year 2004. It is international alliance of libraries developed by association of research libraries. It contains various research and academic groups and libraries that work together in promotion of open access to scholarship. SPARC has been actively involved in promotion of open content philosophy (*Open Education - SPARC Europe*, n.d.).

SPARC has different international chapters also SPARC Europe, SPARC Japan and SPARC Africa. It has around 600 libraries and Academic institutions as global partners.

SPARC Europe is a Dutch foundation and it is Europe's one of the key and long lasting project that is committed to provide unfettered access to education and research and advocates the concept of open science, open access, open education and open scholarships for the higher education community. The major work plans of SPARC focus around policy making, advocacy in open education and various knowledge exchange initiatives. SPARC published a report "Open access: an analysis of publisher copyright and licensing policies in Europe in, 2020". This report provides concrete recommendations and alignment of standards and policies making resources easy to find and understand. This report also highlights the importance of open access and increases literacy about copyright and how to use

creative commons license framework etc. SPARC also published one another report on “An analysis of open science policies in Europe”.

k) Open EduProject Europe

This “Open EduProject” was designed by European commission as a support framework for higher education institutions. This Open Eduproject is one of the 6 priorities of European commission listed under E&T2020 priority list. This priority states “Open and Innovative education and training” by fully embracing the digital era. This priority further states the opening up of education as an innovative teaching and learning for all through open education resources and through new technologies. The Joint Research Centre (JRC) a division of European commission supports this opening up education project. JRC analysed those various factors like quality, efficiency, equity and innovations that are influencing the adoption of Open EduProject and as a result JRC released Open Education framework for higher education. This framework was designed to support the European higher education institutions to make various strategic decisions regarding open education. The framework is a hands-on tool with 10 dimensions of open education. 6 are the core dimensions which includes access, content, pedagogy, recognition, collaboration, technology and research and 4 are transversal dimensions which includes: strategy, leadership, technology and quality (queromi, 2016).

l) Open Access Books Network (OABN)

The Open Access Books Network is an open network where any researcher, publisher, librarians or students who is interested in open access books can join it for freely as it is open for all.

This network was jointly begun by collaboration of many other big and successful initiatives working on Open Access Philosophy in Europe such as OAPEN, OPERAS, Scholrled and SPARC Europe. The open access books network is an online platform and has 15 community contributors and has 125 members. This network is an online space for passionate dialogues and conversations among academic communities and groups about Open Access Books (*Open Access Books Network – A Place to Discuss Open Access Books*, n.d.).

m) OPERAS

OPERAS is an "Open scholarly communication in the European research area for social sciences and humanities". This research infrastructure support was established with an aim to provide scholarly communication and knowledge produced in social sciences and humanities free of cost and without any barriers to the students, researchers and academic groups of Europe and other countries of the world.

"OPERAS provides the research community with the missing brick it needs to find, access, create, edit, disseminate and easily and efficiently validate SSH outputs across Europe. In one word, OPERAS unlocks scholarly communication resources and enables the whole field to reinvent itself in the new open science paradigm (*OPERAS – Open Scholarly Communication in the European Research Area for Social Sciences and Humanities Area through Schola*, n.d.).

n) OAPEN

OAPEN is an online library and publication platform that helps stakeholders in promotion and support related to transition of academic books into open access. It provides a platform that provide open infrastructure services to various stakeholders in scholarly communication. OAPEN collaborates with various publishers and builds an open books collection and work on its collection development, quality control, hosting, dissemination and digital preservation.

OAPEN provides many services such as open books toolkit, deposit services, discovery services and dissemination services.

OA books toolkit: This toolkit helps authors in better understanding the open access books publishing system and help in building authors trust in open access books.

OAPEN deposit service: This deposit service of OAPEN provides uploading services to publishers, authors and researchers. It further deploys the metadata, distribution channels, and classification schemes to these academic books.

OAPEN dissemination services: In order to disseminate the OAPEN collection in a better way and making books in reach of target audience. OAPEN feeds metadata on

daily basis in various formats for libraries and provides freely available harvesting options to disseminate academic books to target audiences (*Online Library and Publication Platform | OAPEN*, n.d.).

OAPEN Discovery services: The open books initiative will be successful only if these free and open books are easily discoverable on the web. The OAPEN library is indexed in google scholar and it is also indexed in directory of Open access books (DOAB).

The OAPEN books are easily searchable in libraries metadata and these open books with open licenses are easily optimizable in search engines.

o) Digital School

Digital School is a Poland Government's program which advocates the use of ICT in schools. Digital School is a national platform for educational resources and contain open textbooks etc. It was formally launched in 2012. This open educational resource repository includes three types of resources (*Digital School E-Textbooks Program: A Year and a Half Later | Infojustice*, n.d.)

- E textbooks certified by Ministry of Education, Poland
- Other educational materials
- Educational TV programs.

p) Wikiwijs

Wikiwijs is a public platform where one can search, create, use and share the open educational materials. All these educational resources are free to use for all.

Wikiwijs was launched by Netherland's minister in 2008, which later on in 2009 was adopted as a public service by Ministry of Education, Culture and Science. It is maintained by Kennisnet. This wikiwijs platform stimulates and supports the use and development of OER education in Europe.

On this platform there are teachers and resources from all levels primary to university education.

The open-source software, open standards and open content is used in the whole project. The main key characteristics to the success of wikiwijs is its collaborations among educational publishers and combination of traditional materials with OER (*Wikiwijs - Find, Create and Share Teaching Materials*, n.d.).

q) Klascement

Klascement is a non-profit organization and is funded by Ministry of Education in Flanders (Belgium). It is open educational resources repository which have around 70 thousand learning resources generated by large number of teachers and some of these are available with open licenses such as creative commons (*KlasCement Leermiddelennetwerk*, n.d.).

r) Learning Resource Exchange

This platform is run by European schoolnet and provide facility to European schools where they can find educational content from other countries and from different providers. It has provided access to a large network of educational resources repositories and this tool has allowed the schools to exchange the quality learning content easily with other country teachers.

Learning resource exchange has large number of resources and content providers which are continuously adding more resources in the platform (*European Schoolnet Learning Resource Exchange Subcommittee*, n.d.).

s) Open Course Ware Initiatives in Different Countries

After the success of MIT open courseware many countries started Open Courseware projects. The details are as below:

- MIT Open course ware was established in 2001.
- CORE (Chinese open resources for education) was established in 2003.
- Paristech open courseware project started in 2003.
- Japanese open course ware consortium was founded in 2006.

- Taiwan open course ware started in 2007.
- Vietnam open courseware started in 2007.
- Vietnam open educational repository (VOER) was started in 2010.
- Virtual university of Pakistan was started in 2011.
- Korean Open courseware started in 2007.
- MOOCS in Japan (JMOOCS) started in 2013.
- France Universite Numerique a French universities MOOCS portal was started in 2013.
- First OER initiative in Afghanistan under the name "The Darakhat- e- Danesh (The Knowledge tree) was started in 2014.

3.8 CONCLUSION

Many open educational resources initiatives at the local, regional, national and international levels have given a boost to this movement to reach scholars and underprivileged students to provide educational material. The movement is getting stronger day by day. Many academic institutions, organisations and Government departments are joining hands in this movement.

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Chapter 4

RESEARCH METHODOLOGY

Research methodology is a systematic, scientific and specific procedure or series of steps to identify and define the research problem, collecting relevant data or information, applying appropriate tools and techniques for data analysis, and interpretation of results or outputs with feedback or feed forward loops at different steps for better insights and discovery of new knowledge.

The present study intends to determine the status and use of open educational resources among the academic community of some of the universities in northern India. The study would cover availability of open educational resources in central university libraries and would also look into the usage of these resources. The study would also inquire about effectiveness of open educational resources in fulfilling academic purposes. Moreover, user's perception about Open educational resources and their satisfaction level will also be tested.

Representative sample and its size, scale or instrument reliability and validity, and use of appropriate data analysis tools and techniques are preliminary steps for conducting valid research. It has been done in the light of data type and research objectives with the application of appropriate technique of data analysis. Interpretation of research findings has been done in the light of research consonance or dissonance not only validates but also adds value to the research outcomes.

This research has emphasized to develop, test, improve and validate research instrument for efficient and effective collection of information, its analysis, and interpreting results for delivering knowledge to the practitioners, strategists, and policy makers. The various steps taken to complete this research are as follow:

4.1 Objectives of the Study

4.2 Hypotheses of the Study

4.3 Scope of the Study

4.1 OBJECTIVES OF THE STUDY

The following objectives are framed for the study;

1) To investigate into the status of use of open educational resources in various central universities of north India.

2) To analyse the user's perception, awareness and attitude towards open educational resources.

3) To study the purpose and extent of using open educational resources by the students and faculty of central universities of North India.

4) To study the motivations and constraints in the use of open educational resources by faculty, research scholars, UG and PG students of central universities of North India.

5) To find out the expected role of librarians in providing and promoting open Educational Resources to their academic community.

4.2 HYPOTHESES OF THE STUDY

To achieve the main objectives of this research study, the following null hypotheses and alternate hypotheses have been formulated in the light of research objectives of the study. These are as follow:

Ho_1: There is no significant difference among respondents regarding awareness about OER.

Ho_2: There is no significant difference among respondents regarding frequency of using OERs.

Ho_3: There is a significant relationship between various constructs of OER and Overall OER Awareness.

Ho_4: There is a significant relation between purpose of using OER and Extent of using OER.

Ho_5: There is statistically significant difference in responses regarding problems faced.

Ho_6: There is a statistically significant difference in responses regarding the role of librarians in handling problems.

4.3 SCOPE OF THE STUDY

There is diversity in the presence of universities in different parts of India. **Table 4.1** shows the presence of Central Universities, State Universities, Deemed Universities, Private Universities and total universities in different states and states and union territories in India.

Table 4.1: List of Universities in India (As on March 2019) State wise list as per UGC / MHRD

States of India	Central Universities	State Universities	Deemed Universities	Private Universities	Total Universities
Andhra Pradesh	01	21	5	6	32
Arunachal Pradesh	01	01	01	7	10
Assam	02	12	01	06	21
Bihar	03	19	01	07	30
Chandigarh	00	01	01	00	02
Chhattisgarh	01	14	-	11	26
Delhi	05	08	10	00	23
Goa	00	01	00	00	01
Gujarat	01	30	03	35	69
Haryana	01	18	06	23	48
Himachal Pradesh	01	05	00	17	23
Jammu and Kashmir	02	09	01	00	12
Jharkhand	01	11	01	14	27
Karnataka	01	29	14	17	61
Kerala	01	13	03	00	17
Madhya Pradesh	02	23	01	33	59
Maharashtra	01	22	21	13	57
Manipur	03	03	00	02	08

States of India	Central Universities	State Universities	Deemed Universities	Private Universities	Total Universities
Meghalaya	01	00	00	08	09
Mizoram	01	00	00	01	02
Nagaland	01	00	00	03	04
Odisha	01	18	03	06	28
Puducherry	01	00	01	00	02
Punjab	01	09	02	15	27
Rajasthan	01	24	08	50	83
Sikkim	00	00	00	00	00
Tamil Nadu	02	22	28	00	52
Telangana	03	18	02	00	23
Tripura	01	01	00	01	03
Uttar Pradesh	06	30	09	29	74
Uttarakhand	01	11	03	17	32
West Bengal	01	26	02	10	39
Total	**48**	**400**	**126**	**337**	**911**

However, in this research only four major universities of North India i.e., Central University, Jammu; Central University, Punjab; Central University, Himachal Pradesh; and Central University, Haryana were considered. It was due to the fact that all these four universities are recently established (less than ten-year-old) and these universities are forerunners in adopting national digital initiatives.

Establishment of Central Universities in India (As on March 2019) State as per UGC / MHRD

The year of establishment of various central universities in North India is shown in **Table 4.2** below:

Table 4.2 Selected Central University libraries in North India for present study

SN	Central Universities of North India	Year of establishment
1	Central University of Punjab, Bathinda	2009
2	Central University of Haryana, Mahendragarh, Haryana	2009
3	Central University of Himachal Pradesh, Dharamshala, HP	2010
4	Central University of Jammu, Jammu	2009

There are at present 10 central Universities in North India. The list of these universities is shown in Table 1.1. Out of ten central universities in North India the four central universities as mentioned in Table 1.3 have been selected for the present study. The criteria adopted for selecting these universities is their year of establishments. All the universities selected are recently established universities and are just ten-year-old as shown in Table 1.2. All these four universities were established by the Central Universities Act no 25 of 2009. The central universities are funded and governed by the central government and are pioneer in adopting government initiatives and recently central government has taken many initiatives in promoting digital India such as Swayam, NPTEL, NDL, and MOOCs, e Pg Pathshala, Gyankosh etc to provide free open educational resources to the academic comm

unity. Most of these open educational resource initiatives are also funded by the central or state governments or government organisations. The Selected four universities are playing active role in promotion and providing access to open educational resources to its users and the same is evident from the websites of these selected universities. The study would help in analyzing the effective usage and

users' behaviour towards these Open Educational Resources. However, for the present study, only four Central University libraries have been selected established after 2009 (excluding Kashmir and UP).

4.4 POPULATION OF THE STUDY

The population of users of these four universities is shown in **Table 4.3** below:

Table 4.3: Population of Four Select Central Universities in North India

SN	Users	Central University of Punjab	Central University of Haryana	Central University of Himachal Pradesh	Central University of Jammu	Total
1	UG	205	520	189	525	1439
2	PG	1090	1219	1121	1908	5338
3	RS	214	135	152	840	1341
4	Faculty	106	55	82	102	345
Total		**1615**	**1929**	**1544**	**3375**	**8463**

Table 4.3 shows the total population of 8463 where maximum population is in Central University, Jammu, followed by Central University, Haryana; Central University, Himachal Pradesh, and Central University, Punjab.

4.5 SELECTION OF SAMPLE AND SAMPLE SIZE

The sample size for this research is selected using well defined Solvin's formula where size of population is known. The Table **4.3** shows the population size of four Central Universities (CU) i.e., Central University of Punjab (CUP), Central University of Haryana (CUH), Central University of Himachal Pradesh (CUHP), and Central University of Jammu (CUJ) in North India. The Solvin's Formula was used to derive the sample size as mentioned below:

$$\text{Sample Size } (n) = \frac{N}{1+Ne^2}$$

Where, n = sample size, N= population size, e = the margin of error (0.05)

$$n = \frac{8463}{1 + 8463(0.05)2}$$

$$n = \frac{8463}{1 + 8463(0.0025)}$$

$$n = \frac{8463}{22.1575} = 381.94$$

n = 381.94

The minimum calculated sample size according to Solvin's formula was 382 respondents. However, a sample size of 710 was used in this research.

4.6 SAMPLING PROCESS

In this research stratified sampling technique was used. It is due to the fact that there were strata's of population. The Solvin's formula was used to calculate minimum sample size. Later, it was distributed along strata's. The minimum sample for each strata in four universities was calculated as shown below and results are discussed in **Table 4.4**.

$$\text{Stratified sample size} = \frac{\text{Total} * \text{Mini Sample}}{\text{Grand Total}}$$

Table 4.4: Stratified sample of select central universities

SN	Users	Central University of Punjab	Central University of Haryana	Central University of Himachal Pradesh	Central University of Jammu	Grand Total	Stratified Sample Size	Responses Used
1	UG	205	520	189	525	**1439**	65	**136**
2	PG	1090	1219	1121	1908	**5338**	241	**267**
3	RS	214	135	152	840	**1341**	61	158
4	Faculty	106	55	82	102	**345**	16	149
Grand Total		**1615**	**1929**	**1544**	**3375**	**8463**		**--**
Stratified Sample Size		**64**	**92**	**70**	**157**		**383**	
Responses Used		158	217	155	180	**--**	**--**	**710**

A list of respondents from each strata was prepared and total 1100 respondents were selected randomly from all strata's using stratified random sampling. Finally, 790 responses were received back justifying a response rate of 71.8%. However, 732 questionnaires were completely filled. The respondents not aware of OER, lacking OER knowledge and never used OER were eliminated from the data. Finally, 710 responses were used for data analysis. The details of responses received is shown in **Table 4.5** below:

Table 4.5: Responses Received from Respondents

Respondents	**Count (% of total)**				**Total Count N (%)**	**Rank (%)**
	Central University of Haryana N (%)	**Central University of Himachal Pradesh N (%)**	**Central University of Jammu N (%)**	**Central University of Punjab N (%)**		
Faculty	32 (4.5)	34 (4.8)	43 (6.1)	40 (5.6)	149 (21.0)	III
RS	37 (5.2)	44 (6.2)	41 (5.8)	36 (5.1)	158 (22.3)	II
UG students	34 (4.8)	22 (3.1)	26 (3.7)	54 (7.6)	**136 (19.2)**	**IV**
PG students	114 (16.1)	55 (7.7)	70 (9.9)	28 (3.9)	**267 (37.6)**	**I**
Total	217 (30.6)	155 (21.8)	180 (25.4)	158 (22.3)	**710 (100.)**	
Rank (%)	**I**	**IV**	II	III		

Table 4.5 shows the responses collected from faculty, undergraduate (UG) students, postgraduate (PG) students, and research scholars. These respondents are the basic unit of analysis taken for the research from the frame of reference of CUs. A list of respondents was compiled and responses were collected both in person and online with Google Form. The use of these two different means to collect data was due to COVID-19 pandemic problem. The maximum responses were received from Central

University, Haryana (30.6%) followed by Central University of Jammu (25.4%), Central University of Punjab (22.3%), and Central University of Himachal Pradesh (21.8%). The participation of respondents includes PG students (37.6%) followed by Research Scholar (22.3%), Faculty (21.0%), and UG students (19.2%) from the total responses collected of 710. The reason behind low percentage of UG students lies in the fact that majority of central universities offer PG and Research related courses and also during Covid pandemic UG students were not available in university campuses. Here, it is pertinent to mention that these respondents' profile shall provide highly valuable insights for the institutions and policy makers to use OER for betterment of the society as a whole.

The gender wise responses of respondents in the CUs received are shown in **Table 4.6**. The maximum responses were received from male (51.1%) followed by female (48.9%). This difference is due to gender wise disparity of literacy rate in North India (Tanushree Chandra, 2019; Census, 2011). The basic purpose of collecting data was to know the gender wise views of the respondents in the light of research objectives.

4.7 DEMOGRAPHIC ANALYSIS OF RESPONDENTS

The gender wise demographic records of respondents whose responses were received are shown in **Table 4.6** hereunder:

Table 4.6: Gender Wise Responses from Respondents of Central Universities

Gender	**Institution Count**				**Total N (%)**	**Rank (%)**
	Central University of Haryana N (%)	**Central University of Himachal Pradesh N (%)**	**Central University of Jammu N (%)**	**Central University of Punjab N (%)**		
Male	86 (12.1)	91 (12.8)	111 (15.6)	75 (10.6)	363 (51.1)	**I**
Female	131 (18.5)	64 (9.0)	69 (9.7)	83 (11.7)	347 (48.9)	**II**
Total	217 (30.6)	155 (21.8)	180 (25.4)	158 (22.3)	**710 (100.0)**	
Rank (%)	**I**	**IV**	**II**	**III**		

Table 4.6 shows that maximum responses (51.1%) were received from male respondents followed by female (48.9%). The age wise responses are shown in **Table 4.7** below:

Table 4.7: Age Wise Responses Received from the Respondents

Age Group	**Institution Count (% of Total)**					**Rank (%)**
	Central University of Haryana N (%)	**Central University of Himachal Pradesh N (%)**	**Central University of Jammu N (%)**	**Central University of Punjab N (%)**	**Total N (%)**	
Below 20	24 (3.4)	23 (3.2)	22 (3.1)	30 (4.2)	99 (13.9)	III
21-30	134 (18.9)	65 (9.2)	97 (13.7)	52 (7.3)	**348 (49.0)**	**I**
31-40	45 (6.3)	41 (5.8)	28 (3.9)	48 (6.8)	162 (22.8)	II
41-50	11 (1.5)	22 (3.1)	32 (4.5)	23 (3.2)	88 (12.4)	**IV**
Above 50	3 (0.4)	4 (0.6)	1 (0.1)	5 (0.7)	13 (1.8)	V
Total	217 (30.6)	155 (21.8)	180 (25.4)	158 (22.3)	**710 (100.0)**	
Rank (%)	**I**	**IV**	II	III		

The age wise responses received from the respondents are shown in **Table 4.7**. The results showed the maximum responses received from the Central University, Haryana (**30.6%**), followed by Central university of Jammu (**25.4%**), Central university of Punjab **(22.3%)**, and Central University of Himachal Pradesh **(21.8%)**. In the age bracket maximum responses were received from age group (21-30) **(49.0%),** followed by age group (31-40) **(22.8%)**, below 20 **(13.9%)**, age group (41-50) **(12.4%)**, and age above 50 **(1.8%)**. The basic reason behind this disparity lies with the age gap in literacy (Tanushree Chandra, 2019, p.**4**).

The data distribution was also checked for normal distribution. It was found that the Kurtosis and Skewness were found within +2 and -2 limits which were statistically acceptable for assumptions of normal distribution. Many researchers have revealed that the Kurtosis cut-offs limits are acceptable within +2 to -2 range (Curran et al.

1996; and George & Mallery, 2010) and +7 to -7 (Hair et al. 2010; Bryne, 2010; and Curran et al. 1996). The Skewness limits fall within the range of +2 to -2 (Hair et al. 2010; Bryne, 2010; and Curran et al. 1996). The analysis of data was done in the light of research objectives. These are discussed in the succeeding sections.

4.8 DATA COLLECTION TOOL

The questionnaires, interviews and observation methods were used to collect primary data. The secondary data was collected from published sources as well as data available on the web sites of UGC and universities.

The observation and interview methods were used to develop a structured questionnaire for this research. Here, pre-pilot and pilot survey were done to improve the questionnaire. Later, large scale survey was done. Here, it is pertinent to mention that a structured, developed and tested questionnaire was used to collect primary data from faculty, UG students, PG students, and research scholars. The data was collected by using stratified simple random sampling.

4.9 STATISTICAL TECHNIQUES USED FOR DATA ANALYSIS

The responses collected were digitized in SPSS (Statistical Package for the Social Sciences) spread sheet using SPSS version 26. The data was carefully coded and organized for analysis. The major analysis includes: descriptive statistics, and use of appropriate statistical techniques in the light of research objectives. The statistical measures like: mean, standard deviation (SD), frequency of responses, percentage of responses, kurtosis, skewness, Analysis of variance (ANOVA), Post Hoc Test and level of significance (p-value), Cronbach's Alpha, Correlation, and Factor Analysis using Principal Component Analysis with Varimax Rotation were used. The structural model was tested with the help of structural equation modeling (SEM) using AMOS 4.0 version.

Here, it is pertinent to mention that mean is helpful to know central tendency for agreement with the construct and SD shall help to know spread from the mean of data. The frequency of responses shall help to know missing values and calculating percentage of responses. The Kurtosis and Skewness are helpful to judge the type of

distribution of data. In this research data was Normal Distributed suggesting to apply parametric tests for analysis of data. ANOVA, which comes under parametric test shall help to test hypothesis based on F-Test and level of significance. The Factor Analysis is useful to group variables for strategic purpose and SEM technique helps in testing multiple structural relations at a time. SEM is also helpful to know total effects for understanding association (positive or negative) between variables and constructs.

4.10 BRIEF DESCRIPTION OF STATISTICAL TESTS USED FOR DATA ANALYSIS

A questionnaire was developed with strong literature support in consultation with practitioners and researchers. It was tested and modified with pre-pilot and pilot survey of 50 respondents. Later, major survey was conducted and tested for reliability and validity using the SPSS 26.0 version. The details regarding use of various statistical measures are as follow:

- **Cronbach's Alpha:** It is a test for internal consistency of data with range from 0.0 to 1.0. According to Nunnally and Bernstein (1994), a value of 0.6 is sufficient to explain internal consistency of scale or scale reliability and validity.

- **Bartlett's test of Sphericity:** It is widely used for testing the null hypothesis (H_0) with the identification of identity matrix. A significant statistical test (≤ 0.05) shows that the correlation matrix is indeed not an identity matrix (rejection of H_0), justifying the suitability to apply Factor Analysis.

- **Correlation:** It is helpful to know the association between variables and constructs. It has range from -1 to 0 to +1. A high positive value shows positive association and lowest negative value shows highest negative association. The zero value shows no association.

- **Percentage:** Percentage is derived from *Latin* word 'per centum' which means 'per hundred'. It is simply percentage of fraction value. In this research percentage is also used to rank various responses.

- **Mean (x): It** is a measure of central tendency or type of average and specifically the investigators use arithmetic mean for the purpose of analysis. Arithmetic mean is defined as the value which is obtained by adding all the items of a series and dividing this total by the number of items. The main purpose is to provide the simple and systematic description of the raw data and it is very helpful in comparison. In this research mean is also used for ranking various responses.

- **Standard Deviation (σ):** The standard deviation is part of the dispersion and helps to discover the variability of the elements, that is, the degree of difference between the values and the center value (Karl Pearson, 1893, n.d). The standard deviation is defined as the square root of the arithmetic mean of the squared deviation of the mean value.

- **Chi-Square (χ^2)** is a statistical test that is used to compare observed data with expected data. It can also be used as a goodness-of-fit test and attribute independence test. The chi-square test is also called a non-parametric test that was developed by Karl Pearson in 1900. The test uses the null hypothesis, which determines that there is no correlation between the two variables. Here, it is pertinent to mention that Chi-square is robust non-parametric test where data was measured on nominal (categorical) variables to compare two or more groups (Hair et al. 2010).

- **Analysis of Variance (ANOVA):** It is a parametric test (used for Normal Distributed data) helpful in comparing means of different categorical variables. It uses F-values, degree of freedom, and level of significance. Generally, if the level of significance is ≤ 0.05 (95%), there is significant statistical difference between categorical variables under comparison. However, **Post Hoc Tests** control the family-wise error rate (inflated type I error rate) due to multiple comparisons (Hair et al., 2010).

- **Communality**: It is the total amount of variance shared by an original variable with all other variables included in the analysis. It is a pre-requisite for conducting factor analysis. A communality above 0.4 is sufficient for conducting Factor Analysis (Hair et al., 2010).

- **Principal Component Analysis:** It is a statistical technique used in the factor analysis level to clarify group variables in the form of factors or groups.

- **Structural Equation Modelling (SEM):** It is a multivariate statistical technique that allows researchers to estimate and test causality (cause and effect). It is used to analyse the relationships simultaneously. This method is used to examine the combined effects of one or more independent variables, which are plotted on a path diagram, sometimes called path analysis in a broad sense.

4.11 TESTING SCALE RELIABILITY AND VALIDITY

In this section the scale reliability and validity were tested to justify scale used for analysis of data under different objectives in the following ways:

4.11.1 Scale Reliability

Reliability is the extent to which the measure of a construct is consistent or dependable. **Inter-rate reliability** or **inter-observer reliability** were tested by asking questions to the respondents in two or more different ways. It was found that more than 80% responses were matching during pre-pilot survey, pilot survey and large-scale survey. **Test and re-test reliability** was also done by administering same questionnaire to same people during pre-pilot, pilot and large-scale survey. The **split half reliability** was also done during pre-pilot, pilot and large-scale survey by testing data in two halves. The results were found consistent. We have used Cronbach's Alpha which was suggested by Lee Cronbach in 1951, using SPSS 26.0 version yielded value of more than 0.6 of Cronbach's Alpha (Hair et al., 2010).

4.11.2 Scale Validity

In this research an effort was made to develop valid research instrument. An extensive attention was paid for face, content and discriminant validity. **Face validity** was done by selecting reasonable variable and questions within a construct and in the questionnaire. The questionnaire was prepared with strong literature support and in consultation of academicians, practitioners and users extensively conducting pre-pilot and pilot survey to improve the instrument for conducting research. Many contents were added and deleted before conducting large scale survey. Similarly, **Content**

validity was done for the agreement of experts for content of the instrument. **Discriminant validity** was also done for variables loading only on one factors or construct.

In this research an attempt has been made to select suitable profiles of respondents in the light of research objectives. The major profile of respondents selected at the faculty, undergraduate, postgraduate and research scholar level, also included demographics of age and gender of respondents in the light of research study. Here, it is pertinent to mention that the selection of respondents' profile is linked with the research design, research questions and aims of the study (Gillian Symon& Catherine Cassell, 2012, p.36).

The profiles of respondents are as explained as hereunder:

(a) Faculty: Faculty includes all the teaching fraternity which includes Regular, Part-time, Guest faculty and non-teaching academic community like (Assistant Librarians and above, Physical education teachers and Training and Placement employees)

(b) Undergraduate Students: Under graduate students pursuing under graduate course in regular mode.

(c) Postgraduate Students: Post Graduate students includes all students pursuing masters, post graduate degrees/ diplomas in regular mode.

(d) Research Scholars: Research scholars includes all the full and part-time Ph.d and M. Phil research scholars.

4.12 LIMITATIONS OF THE STUDY

The scope of the present study is limited only to the four central universities of north India. The study is limited to only faculty, undergraduate students, postgraduate students and research scholars studying at the main campus of these universities. The off-campus students and centres were not included in the present study. The study was conducted during the academic year 2020-2021 alone.

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Chapter 5

DATA ANALYSIS AND INTERPRETATION

Research methodology is a systematic, scientific and specific procedure or series of steps to identify and define the research problem, collecting relevant data or information, applying appropriate tools and techniques for data analysis, and interpretation of results or outputs with feedback or feedforward loops at different steps for better insights for discovering of new knowledge. The ultimate aim is to fill a gap in knowledge and solve a problem.

Representative sample and its size, scale or instrument reliability and validity, and use of appropriate data analysis tools and techniques are preliminary steps for conducting valid research. It has been done in the light of data type and research objectives with the application of appropriate technique of data analysis. Interpretation of research findings has been done in the light of research consonance or dissonance not only to validates but also to add value to the research outcomes. This research has emphasized to develop, test, improve and validate research instrument for efficient and effective collection of information, analysis and interpreting results for delivering knowledge to the practitioners, strategists, and policy makers. The various steps taken to complete this research are as follow:

5.1 Selection of Sample and Sample Size

5.2 Sampling Process

5.3 Testing Scale Reliability and Validity

5.4 Demographic Analysis of Respondents

5.5 Objective wise Analysis of Data

The selection of sample and its size, scale reliability and validity have been done as discussed in the succeeding sections.

5.1 SELECTION OF SAMPLE SIZE

The process of sample size selection has been explained in detail at 4.5 in Research Methodology chapter.

5.2 SAMPLING PROCESS

The sampling process is explained in detail at 4.6 in Research Methodology chapter.

5.3 SCALE RELIABILITY AND VALIDITY

In this section the scale reliability and validity were tested to justify scale used for analysis of data under different objectives in the following ways:

5.3.1 Scale Reliability

Reliability is the extent to which the measure of a construct is consistent or dependable. **Inter-rater reliability** or **inter-observer reliability** was tested by asking questions to the respondents in two or more different ways. It was found that more than 80% responses were matching during pre-pilot survey, pilot survey and large-scale survey. **Test and re-test reliability** was also done by administering same questionnaire to same people during pre-pilot, pilot and large-scale survey. The **split half reliability** was also done during pre-pilot, pilot and large-scale survey by testing data in two halves. The results were found consistent. We have used Cronbach's Alpha which was suggested by Lee Cronbach in 1951, using SPSS 26.0 version yielded value of more than 0.6 of Cronbach's Alpha (Hair et al., 2010).

5.3.2 Scale Validity

In this research an effort was made to develop valid research instrument. An extensive attention was paid for face, content and discriminant validity. **Face validity** was done by selecting reasonable variable and questions within a construct and in the questionnaire. The questionnaire was prepared with strong literature support and in consultation of academicians, practitioners and users extensively by conducting pre-pilot and pilot survey to improve the instrument for conducting research. Many contents were added and deleted before conducting large scale survey. Similarly

Content validity was done for the agreement of experts for content of the instrument. **Discriminant validity** was also done for variables loading only on one factors or construct.

In this research an attempt has been made to select suitable profiles of respondents in the light of research objectives. The major profile of respondents selected are the faculty, undergraduate, postgraduate and research scholar level also included demographics of age and gender of respondents in the light of research study. Here, it is pertinent to mention that the selection of respondents' profile is linked with the research design, research questions and aims of the study (Gillian Symon and Catherine Cassell (2012), p.36).

Table 5.1: Institution wise Responses received from faculty, UG students, PG students, and Research Scholars

Respondents	**Count (% of total)**				**Total Count (% of total)**	**Rank (%)**
	Central University of Haryana	**Central University of Himachal Pradesh**	**Central University of Jammu**	**Central University of Punjab**		
Faculty	32 (4.5%)	34 (4.8%)	43 (6.1%)	40 (5.6%)	149 (21.0%)	III
UG students	34 (4.8%)	22 (3.1%)	26 (3.7%)	54 (7.6%)	**136 (19.2%)**	**IV**
PG students	114 (16.1%)	55 (7.7%)	70 (9.9%)	28 (3.9%)	**267 (37.6%)**	**I**
Research Scholar	37 (5.2%)	44 (6.2%)	41 (5.8%)	36 (5.1%)	158 (22.3%)	II
Total	217 (30.6%)	155 (21.8%)	180 (25.4%)	158 (22.3%)	**710 (100.0%)**	
Rank (%)	**I**	**IV**	II	III		

Source: Researcher's Calculations based on Primary Data

Table 5.1 shows the responses collected from faculty, under graduate (UG) students, post graduate (PG) students, and research scholars. These respondents are the basic unit of analysis taken for the research from the frame of reference of CUs. The maximum responses were received from Central University, Haryana (30.6%)

followed by Central University of Jammu (25.4%), Central University of Punjab (22.3%), and Central University of Himachal Pradesh (21.8%). The participation of respondents include PG students (37.6%) followed by Research Scholar (22.3%), Faculty (21.0%), UG students (19.2%) from the total responses collected of 710. The reason behind low percentage of UG students lies with the fact that majority of central universities offer PG and Research related courses. Moreover, the data was collected during Covid 19 Pandemic and at that time in university campuses the presence of UG students was less as compared to the PG students and Research Scholars. Here, it is pertinent to mention that these respondent's profile shall provide highly valuable insights for the institutions and policy makers to create and use OER for betterment of the society as a whole.

The gender wise responses of respondents in the CUs received are shown in **Table 5.2**. The maximum responses were received from males (51.1%) followed by females (48.9%). This difference is due to gender wise disparity of literacy rate in North India (Tanushree Chandra, 2019; Census, 2011). The basic purpose of collecting data was to know the gender wise views of the respondents in the light of research objectives.

Table 5.2: Gender wise responses from respondents of central universities

Gender	**Institution Count (% of Total)**				**Total (% of Total)**	**Rank (%)**
	Central University of Haryana	**Central University of Himachal Pradesh**	**Central University of Jammu**	**Central University of Punjab**		
Male	86 (12.1%)	91(12.8%)	111(15.6%)	75 (10.6%)	363(51.1%)	**I**
Female	131(18.5%)	64 (9.0%)	69 (9.7%)	83 (11.7%)	347 (48.9%)	**II**
Total	217 (30.6%)	155 (21.8%)	180 (25.4%)	158 (22.3%)	**710 (100.0%)**	
Rank (%)	**I**	**IV**	**II**	**III**		

Source: Researcher's Calculations based on Primary Data

Table 5.3 : Category wise responses from respondents of central universities

Respondents	Count (% of Total)				Total Count (% of total)	Rank (%)
	Central University of Haryana	Central University of Himachal Pradesh	Central University of Jammu	Central University of Punjab		
Faculty	32 (4.5%)	34 (4.8%)	43 (6.1%)	40 (5.6%)	149 (21.0%)	III
UG students	34 (4.8%)	22 (3.1%)	26 (3.7%)	54 (7.6%)	**136 (19.2%)**	**IV**
PG students	114 (16.1%)	55 (7.7%)	70 (9.9%)	28 (3.9%)	**267 (37.6%)**	**I**
Research Scholar	37 (5.2%)	44 (6.2%)	41 (5.8%)	36 (5.1%)	158 (22.3%)	II
Total	217 (30.6%)	155 (21.8%)	180 (25.4%)	158 (22.3%)	**710 (100.0%)**	
Rank (%)	**I**	**IV**	II	III		

Source: Researcher's Calculations based on Primary Data

Table 5.3 shows the responses collected from faculty, under graduates (UG) students, post graduate (PG) students, and research scholars. These respondents are the basic unit of analysis taken for the research from the frame of reference of CUs. The maximum responses were received from Central University, Haryana (30.6%) followed by Central University of Jammu (25.4%), Central University of Punjab (22.3%), and Central University of Himachal Pradesh (21.8%). The participation of respondents include PG students (37.6%) followed by Research Scholar (22.3%), Faculty (21.0%), UG students (19.2%) from the total responses collected of 710. The reason behind low percentage of UG students lies with the fact that majority of central universities offer PG and Research related courses.

Table 5.4: Age wise responses received from the respondents

Age Group	Institution Count (% of Total)					Rank (%)
	Central University of Haryana	Central University of Himachal Pradesh	Central University of Jammu	Central University of Punjab	Total (% of Total)	
Below 20	24 (3.4%)	23 (3.2%)	22 (3.1%)	30 (4.2%)	99 (13.9%)	III
21-30	134 (18.9%)	65 (9.2%)	97 (13.7%)	52 (7.3%)	**348 (49.0%)**	**I**
31-40	45 (6.3%)	41 (5.8%)	28 (3.9%)	48 (6.8%)	162 (22.8%)	II
41-50	11(1.5%)	22 (3.1%)	32 (4.5%)	23 (3.2%)	88 (12.4%)	**IV**
Above50	3 (0.4%)	4 (0.6%)	1 (0.1%)	5 (0.7%)	13 (1.8%)	V
Total	217 (30.6%)	155 (21.8%)	180 (25.4%)	158 (22.3%)	**710 (100.0%)**	
Rank (%)	**I**	**IV**	II	III		

Source: Researcher's Calculations based on Primary Data

The age wise responses received from the respondents are shown in **Table 5.4**. The results showed the maximum responses received from the Central University, Haryana (**30.6%**), followed by Central university of Jammu (**25.4%**), Central university of Punjab **(22.3%)**, and Central University of Himachal Pradesh **(21.8%)**. In the age group maximum responses were received from age group (21-30) **(49.0%),** followed by age group (31-40) **(22.8%)**, below 20**(13.9%)**, age group (41-50) **(12.4%)**, and age above 50 **(1.8%)**. The basic reason behind this disparity lies with the age gap in literacy (Tanushree Chandra, 2019, p.4).

The data distribution was also checked for normal distribution. It was found that the Kurtosis and Skewness were found within +2 and -2 limits which was statistically acceptable for assumptions of normal distribution. Many researchers have revealed that the Kurtosis cut-offs limits are acceptable within +2 to -2 range (Curran et al.

1996; and George & Mallery, 2010) and +7 to -7 (Hair et al. 2010; Bryne, 2010; and Curran et al. 1996). The Skewness limits fall within the range of +2 to -2 (Hair et al. 2010; Bryne, 2010; and Curran et al. 1996). The analysis of data was done in the light of research objectives. These are discussed in the succeeding sections.

5.4 Objective I: USE OF OPEN EDUCATIONAL RESOURCES IN CENTRAL UNIVERSITIES

Under this objective an attempt has been made to present the status of awareness and use of OER in the Central Universities of North India. These are discussed as follow:

Table 5.5 : ICT familiarity of the respondents in central universities of North India

ICT Familiarity Scale	Measure	Central University of Haryana	Central University of Himachal Pradesh	Central University of Jammu	Central University of Punjab	Total
Excellent	Count (% of Total)	60 (8.5)	42 (5.9)	30 (4.2)	30 (4.2)	162 (22.8)
Good	Count (% of Total)	105 (14.8)	64 (9)	125 (17.6)	96 (13.5)	390 (54.9)
Average	Count(% of Total)	50 (7)	41 (5.8)	22 (3.1)	29 (4.1)	142 (20)
Below Average	Count (% of Total)	2 (0.3)	8 (1.1)	3 (0.4)	3 (0.4)	16 (2.3)
Total	Count (% of Total)	217 (30.6)	155 (21.8)	180 (25.4)	158(22.3)	710 (100)

Source: Researcher's Calculations based on Primary Data

The results of **Table 5.5** shows that familiarity of respondents as Excellent (22.8%), Good (54.9%), Average (20%), and Below Average (2.3%). The responses regarding sources of open education are shown in **Table 5.6** below:

Table 5.6: Responses regarding source of information about open educational Resources from respondents in central universities of North India

Source of Information about OER	Central University of Haryana	Central University of Himachal Pradesh	Central University of Jammu	Central University of Punjab	Total	Rank (%)
Conference	25 (3.5)	13 (1.8)	29 (4.1)	8 (1.1)	75 (10.6)	**IV**
Internet search	73 (10.3)	20 (2.8)	77 (10.8)	84 (11.8)	254 (35.8)	**I**
email	8 (1.1)	9 (1.3)	9 (1.3)	4 (0.6)	30 (4.2)	**VII**
Institutional library	9 (1.3)	28 (3.9)	8 (1.1)	18 (2.5)	63 (8.9)	**V**
Teacher/ Research Supervisor	56 (7.9)	21 (3)	21 (3)	14 (2)	112 (15.8)	**II**
Friend/ Colleague	29 (4.1)	33 (4.6)	26 (3.7)	13 (1.8)	101 (14.2)	**III**
Self learning	11 (1.5)	27 (3.8)	6 (0.8)	14 (2)	58 (8.2)	**VI**
Other Sources	6 (0.8)	4 (0.6)	4 (0.6)	3 (0.4)	17 (2.4)	**VIII**
Total	217 (30.6)	155 (21.8)	180 (25.4)	158 (22.3)	710 (100)	

Measure : Count (% of Total)

Source: Researcher's Calculations based on Primary Data

The respondents were asked from which source they came to know about OERs. The results in **Table 5.6** show that Internet search was a major source of information about open educational resources followed by Teacher/Research Supervisor, Friend/Colleague, Conference, Institutional library, Self-learning, email, and other sources.

The OER awareness of respondents is shown in **Table 5.7** below:

Table 5.7: Institution wise Awareness regarding open educational resources by respondents in central universities of North India

OER Awareness	Central University of Haryana	Central University of Himachal Pradesh	Central University of Jammu	Central University of Punjab	Total
Not at all aware	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Slightly aware	119 (16.76)	87 (12.25)	60 (8.45)	90 (12.67)	356 (50.14)
Fully aware	98 (13.8)	68 (9.6)	120 (16.9)	68 (9.6)	354 (49.86)
Total	217 (30.6)	155 (21.8)	180 (25.4)	158 (22.3)	710 (100)

Measure : Count (% of Total)

Source: Researcher's Calculations based on Primary Data

The respondents were asked about their level of awareness about OER

The OER awareness of respondents **Table 5.7** shows that all respondents taken in this study were aware of OER. The results showed that 50.14% respondents were slightly aware of OER and 49.86% respondents were fully aware of OER.

The scale statistics of Awareness regarding OER is shown in **Table 5.8**. The data distribution was also checked for Normal distribution. It has been found that the mean of 2.47 on 3-point Likert scale has explained 82.3% construct which is sufficient for validity of the scale construct (Hair et al., 2010). Hence, parametric tests that assume Normal Distribution shall be applied (Hair et al., 2010).

Table 5.8: Scale statistics of awareness about open educational resources

Variable	Std. Dev.	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
OER Awareness	.558	.311	-.409	.092	-.864	.183
Mean=2.47						

To achieve this objective, the respondents were asked about their level of awareness about OER. The responses collected are further classified using Cross Tabulation Method based on the category of users and their level of awareness about open educational resources. The details are mentioned in the **Table 5.9**.

Table 5.9 : Awareness about Open Educational Resources

OER Awareness	**Users Category (%)**					**Chi – Square Value**
	Faculty	**UG students**	**PG students**	**Research Scholar**	**Total (%)**	
Fully aware	88 (12.39)	63 (8.87)	144 (20.28)	59 (8.3)	354 (49.9%)	$x^2 = 28.929$
Slightly aware	60 (8.45)	63 (8.87)	115 (16.19)	96 (13.52)	334 (47.0%)	$df = 6$
Not at all aware	1 (0.14)	10 (1.40)	8 (1.12)	3 (0.42)	22 (3.1%)	$p = .000$
Total	**149 (20.98)**	**136 (19.15)**	**267 (37.60)**	**158 (22.25)**	**710 (100)**	

Source: Researcher's Calculations based on Primary Data

Table 5.9 reveals that majority that is 354(49.9%) are fully aware of OER followed by 334 (47.0%) respondents who are slightly aware, and only 22(3.1%) are not at all aware. As a result, 96.9% respondents are aware of OER and only 3.1% are not aware of OER. However, results of Chi-square have showed that there is a significant difference in responses from faculty, UG students, PG students and Research Scholars.

The following hypotheses was tested.

H_{01}: There is no significant difference between respondents regarding awareness about OER.

$$\mathbf{H_{01}: \mu 1 = \mu 2 = \mu 3 = \mu 4}$$

To further explore the difference an attempt was made to know the statistical difference in means of responses among faculty (**μ1**), UG students (**μ2**), PG students

(**μ3**) and researchers (**μ4**). Post Hoc (Tukey HSD) multiple comparison test is applied. This test is widely used for comparing multiple groups to test hypotheses using ANOVA (Hair et al., 2010). The Post Hoc (Tukey HSD) test results are shown in **Table 5.10** below:

Table 5.10: Post Hoc (Tukey HSD) Test of multiple comparison regarding OER awareness

(I) Category	(J) Category	Mean Difference (I-J)	Std. Error	Sig.	Remarks
Faculty	**UG students**	.194*	.066	**.017**	**H_0 Rejected**
	PG students	.075	.056	.551	**H_0** Accepted
	Research Scholar	.229*	.063	**.002**	**H_0 Rejected**
UG students	**Faculty**	-.194*	.066	.017	**H_0 Rejected**
	PG students	-.120	.058	.169	H0 Accepted
	Research Scholar	.035	.065	.948	H0 Accepted
PG students	Faculty	-.075	.056	.551	H0 Accepted
	UG students	.120	.058	.169	H0 Accepted
	Research Scholar	.155*	.055	**.027**	**H_0 Rejected**
Research Scholar	Faculty	-.229*	.063	**.002**	**H_0 Rejected**
	UG students	-.035	.065	.948	H0 Accepted
	PG students	-.155*	.055	**.027**	**H_0 Rejected**
*. The mean difference is significant at the 0.05 level.					

Source: Researcher's Calculations based on Primary Data

The above **Table 5.10** shows the results of Post Hoc (Tukey HSD) multiple comparison test regarding OER awareness among faculty, researchers, PG and UG students. The results are discussed as follow:

The comparison of **Faculty** with PG students revealed that there was no statistical significance difference as the value (Significance level) was more than 0.05 (95% level of significance) accepting H0. However, the comparison of **Faculty** with UG students and Research Scholars shows statistically significant (Significance level>0.05). Hence, $\mathbf{H_{01}}$ was rejected. The comparison of **UG students** with PG students and Research Scholars, has revealed no statistical significance difference in mean resulting acceptance of Ho. On the other side when UG students were compared with Faculty, there was a statistical significance difference (≤0.05), resulting rejection of $\mathbf{H_{01}}$.

The comparison of PG students' responses found that Ho was accepted for comparing with Faculty and UG students. While comparison of PG students with Research Scholars found statistically significant difference resulting rejection of $\mathbf{H_{01}}$. In comparing **Research Scholars** responses, it was found that Ho was accepted for mean difference significance level of Faculty and UG students. However, while comparison PG students, there was a statistically significant difference resulting rejection of $\mathbf{H_{01}}$. Hence, it is concluded that **OER awareness are** higher for faculty as compared with mean responses of UG Students (0. 194), and PG Students (0.075), and Research scholars (0.229).

The frequency of OER use is shown in **Table 5.11** below:

Table 5.11: Institution wise Frequency of using open educational resources by respondents in central universities of North India

OE Frequency	Central University of Haryana	Central University of Himachal Pradesh	Central University of Jammu	Central University of Punjab	Total	Rank (%)
Once in a week	54 (7.6)	44 (6.2)	18 (2.5)	40 (5.6)	156 (22)	**II**
Once in a month	25 (3.5)	8 (1.1)	20 (2.8)	18 (2.5)	71 (10)	**III**
As and when required	119 (16.8)	98 (13.8)	136 (19.2)	79 (11.1)	432 (60.8)	**I**

OE Frequency	Central University of Haryana	Central University of Himachal Pradesh	Central University of Jammu	Central University of Punjab	Total	Rank (%)
Once in six months	19 (2.7)	5 (0.7)	6 (0.8)	21 (3)	51 (7.2)	**IV**
Total	217 (30.6)	155 (21.8)	180 (25.4)	158 (22.3)	710 (100)	

Measure : Count (% of Total)

Source: Researcher's Calculations based on Primary Data

The frequency of using OER **Table 5.11** showed that respondents have maximum response for 'As and when required' followed by 'Once in a week', 'Once in a month', and 'once in six months'.

The following hypotheses was formulated for the study.

H_{02}: There is no significant difference between respondents regarding frequency of using OERs.

Table 5.12: Category wise Frequency of using open educational resources by respondents in central universities of North India

Frequency of Using OER	Users Category				Total	Chi – Square (χ^2)
	Faculty	UG students	PG students	Research Scholar		
Once in a week	34	22	63	37	156 (22%)	$x^2 = 16.259$ $df = 9$ $p = .062$
Once in a month	16	20	26	9	71 (10%)	
As and when required	94	81	162	95	432 (60.8%)	
Never used	5	13	16	17	51 (7.2%)	
Total	**149**	**136**	**267**	**158**	**710**	

Source: Researcher's Calculations based on Primary Data

Table 5.12 reveals that the frequency of using OERs for majority of respondents that is 432 (60.8%) is primarily need based as they use OERs only as and when they are required. The frequency of using OER for 156 (22%) respondents are once in a week, 71 (10%) use them once in a month and 51 (7.2%) had never used OERs. The Chi-square value of $x^2 = 16.259$, $df = 9$, and $p = .062$. Shows that the level of significance is more than 0.05 hence, there is no statistically significance difference in responses of faculty, UG students, PG students, and Research Scholars regarding frequency of using OER. Here, $\mathbf{H_{02}}$ is accepted.

The knowledge regarding OER is shown in **Table 5.13**.

Table 5.13: Knowledge of open educational resources responses by respondents in central universities of North India

OER Knowledge	Central University of Haryana	Central University of Himachal Pradesh	Central University of Jammu	Central University of Punjab	Total
Slightly aware	26 (3.7)	6 (0.8)	9 (1.3)	20 (2.8)	61 (8.6)
Moderately aware	103 (14.5)	87 (12.3)	55 (7.7)	92 (13)	337 (47.5)
Fully aware	88 (12.4)	62 (8.7)	116 (16.3)	46 (6.5)	312 (43.9)
Total	217 (30.6)	155 (21.8)	180 (25.4)	158 (22.3)	710 (100)

Measure : Count (% of Total)

Source: Researcher's Calculations based on Primary Data

The respondents were asked about their knowledge regarding OER in detail. The knowledge regarding OER (**Table 5.13)** showed moderately aware by (47.5%) followed by fully aware (43.9%) and slightly aware (8.6%). The results also revealed that majority of respondents have knowledge regarding OER. The CCL awareness is shown in **Table 5.14** below:

Table 5.14: The creative commons license awareness of respondents in central universities of North India

CCL Awareness	Central University of Haryana	Central University of Himachal Pradesh	Central University of Jammu	Central University of Punjab	Total
Slightly aware	100 (14.1)	77 (10.8)	76 (10.7)	120 (16.9)	373 (52.5)
Fully aware	117 (16.5)	78 (11)	104 (14.6)	38 (5.4)	337 (47.5)
Total	217 (30.6)	155 (21.8)	180 (25.4)	158 (22.3)	710 (100)

Measure : Count (% of Total)

Source: Researcher's Calculations based on Primary Data

The CCL awareness showes (**Table 5.14**) that 52.5% respondents are slightly aware and 47.5% respondents were fully aware. The responses regarding OER used and OER time are shown in **Table 5.15** below:

Table 5.15: The OER used and OER time responses of respondents in central universities of North India

Response	Scale	Central University of Haryana	Central University of Himachal Pradesh	Central University of Jammu	Central University of Punjab	Total (%)
OER Used	Never Used	0 (0)	0 (0)	0 (0)	7 (1)	7 (1)
	Occasionally Used	43 (6.1)	27 (3.8)	28 (3.9)	42 (5.9)	140 (19.7)
	Frequently used	174 (24.5)	128 (18)	152 (21.4)	109 (15.4)	563 (79.3)
	Total	217 (30.6)	155 (21.8)	180 (25.4)	158 (22.3)	710 (100)

Response	Scale	Central University of Haryana	Central University of Himachal Pradesh	Central University of Jammu	Central University of Punjab	Total (%)
OER Time	Less than an hour	103 (14.5)	28 (3.9)	22 (3.1)	49 (6.9)	202 (28.5)
	Between 1 to 2 hrs	66 (9.3)	71 (10)	109 (15.4)	53 (7.5)	299 (42.1)
	More than 2 hrs	48 (6.8)	56 (7.9)	49 (6.9)	56 (7.9)	209 (29.4)
	Total	217 (30.6)	155 (21.8)	180 (25.4)	158 (22.3)	710 (100)

Measure : Count (% of Total)

Source: Researcher's Calculations based on Primary Data

The OER used and OER time responses (**Table 5.15**) revealed that the users of OER is: Never Used (1%), Occasionally Used (19.7%), and Frequently Used (79.3%).

The respondents were asked about how much time they spend on accessing OER. The OER time-span use results have revealed: Less than an hour (28.5%), Between 1 to 2 hrs (42.1%), and more than 2 hrs (29.4%).

There are a large number of OER initiatives going on in India. The respondents were asked about the awareness and usage of these initiatives. The awareness regarding EPG Pathshala and NPTEL is shown in **Table 5.16** below:

Table 5.16: The e-PGPathshala and NPTEL awareness of respondents in central universities of North India

OER	Scale	Central University of Haryana	Central University of Himachal Pradesh	Central University of Jammu	Central University of Punjab	Total (%)	Rank (%)
e -PG Pathshala	Not Aware	2 (0.28)	7 (0.98)	3 (0.42)	6 (0.84)	18 (2.5)	**III**
	Aware only	122 (17.18)	92 (12.95)	134 (18.87)	98 (13.8)	446 (62.8)	**I**
	Aware and used	93 (13.1)	56 (7.9)	43 (6.1)	45 (6.3)	237 (33.4)	**II**
	Total	217 (30.6)	155 (21.8)	180 (25.4)	158 (22.3)	710 (100)	
NPTEL	Not Aware	3 (0.42)	4 (5.6)	7 (0.98)	3 (0.42)	17 (2.39)	**III**
	Aware only	146 (20.56)	96 (13.52)	110 (15.49)	117 (16.5)	469 (66.1)	**I**
	Aware and used	68 (9.6)	55 (7.7)	63 (8.9)	38 (5.4)	224 (31.5)	**II**
	Total	217 (30.6)	155 (21.8)	180 (25.4)	158 (22.3)	710 (100)	

Measure : Count (% of Total)

Source: Researcher's Calculations based on Primary Data

The awareness regarding e-PGPathshala and NPTEL (**Table 5.16)** showed that only 2.5% respondents were not aware of e-PGPathshala, and only 2.39% respondents were not aware of NPTEL. The findings showed that awareness about NPTEL is more than e-PGPathshala. The results showed the validity of respondents to impart important contribution towards OER under this study.

Table 5.17: Responses from respondents regarding awareness of Sakshat, E-GYankosh, NROER, and MIT

OER	Scale	Central University of Haryana	Central University of Himachal Pradesh	Central University of Jammu	Central University of Punjab	Total (%)
Sakshat	Not Aware	16 (2.25)	9 (1.26)	8 (1.12)	5 (0.7)	**38 (5.3)**
	Aware only	138 (19.43)	93 (13.1)	111 (15.63)	126 (17.74)	468 (65.91)
	Aware and used	63 (8.9)	53 (7.5)	61 (8.6)	27 (3.8)	204 (28.7)
	Total	217 (30.6)	155 (21.8)	180 (25.4)	158 (22.3)	710 (100)
E-GYankosh	Not Aware	9 (1.26)	2 (0.28)	5 (0.7)	6 (0.84)	**23 (3.24)**
	Aware only	142 (20)	85 (11.97)	136	109 (19.15)	472 (66.48)
	Aware and used	66 (9.3)	68 (9.6)	39 (5.5)	43 (6.1)	216 (30.4)
	Total	217 (30.6)	155 (21.8)	180 (25.4)	158 (22.3)	710 (100)
NROER	Not Aware	12 (1.6)	17 (2.4)	4 (0.56)	10 (1.4)	**43 (6)**
	Aware only	155 (21.83)	102 (14.4)	90 (12.68)	129 (18.17)	476 (67.04)
	Aware and used	50 (7.0)	36 (5.1)	86 (12.1)	19 (2.7)	191 (26.9)
	Total	217 (30.6)	155 (21.8)	180 (25.4)	158 (22.3)	710 (100)
MOOCS	Not Aware	2 (0.28)	4 (0.56)	4 (0.56)	7 (1)	**17 (2.39)**
	Aware only	139	100	153	104	496 (69.86)
	Aware and used	76 (10.7)	51 (7.2)	23 (3.2)	47 (6.6)	197 (27.7)
	Total	217 (30.6)	155 (21.8)	180 (25.4)	158 (22.3)	710 (100)

OER	Scale	Central University of Haryana	Central University of Himachal Pradesh	Central University of Jammu	Central University of Punjab	Total (%)
Connexions	Not Aware	107 (15.1)	87 (12.3)	81 (11.4)	125 (17.6)	**400 (56.3)**
	Aware only	43 (6.1)	12 (1.7)	21 (3)	8 (1.1)	84 (11.8)
	Aware and used	67 (9.4)	56 (7.9)	78 (11)	25 (3.5)	226 (31.8)
	Total	217 (30.6)	155 (21.8)	180 (25.4)	158 (22.3)	710 (100)
MIT	Not Aware	74 (10.4)	76 (10.7)	58 (8.2)	85 (12)	**293 (41.3)**
	Aware only	67 (9.4)	25 (3.5)	75 (10.6)	30 (4.2)	197 (27.7)
	Aware and used	76 (10.7)	54 (7.6)	47 (6.6)	43 (6.1)	220 (31)
	Total	217 (30.6)	155 (21.8)	180 (25.4)	158 (22.3)	710 (100)
YouTube	Not Aware	17 (2.4)	12 (1.7)	16 (2.3)	31 (4.4)	**76 (10.7)**
	Aware only	159 (22.4)	103 (14.5)	151 (21.3)	102 (14.4)	515 (72.5)
	Aware and used	41 (5.8)	40 (5.6)	13 (1.8)	25 (3.5)	119 (16.8)
	Total	217 (30.6)	155 (21.8)	180 (25.4)	158 (22.3)	710 (100)

Measure : Count (% of Total)

Source: Researcher's Calculations based on Primary Data

Table 5.17 shows that 'Not Aware' about Sakshat (5.3%) E-GYankosh (3.24%), NROER (6%), MOOCS (2.39%), Connexions (56.3%), MIT (41.3%), and YouTube (10.7%) respectively. The findings suggest that awareness about YouTube and MOOCS are the most among the respondents. The awareness regarding other OERs is shown in **Table 5.18**.

Table 5.18: Awareness of respondents regarding OERs by Institutions, Wiki sources, Khan Academy, Merlot, and Swayam in central universities of North India

OER Scale	Central University of Haryana	Central University of Himachal Pradesh	Central University of Jammu	Central University of Punjab	Total (%)	Scale
OER by Institutions	Not Aware	52 (7.3)	24 (3.4)	44 (6.2)	69 (9.7)	**189 (26.6)**
	Aware only	119 (16.8)	102 (14.4)	100 (14.1)	50 (7)	371 (52.3)
	Aware and used	46 (6.5)	29 (4.1)	36 (5.1)	39 (5.5)	150 (21.1)
	Total	217 (30.6)	155 (21.8)	180 (25.4)	158 (22.3)	710 (100)
Wiki sources	Not Aware	17 (2.4)	12 (1.7)	16 (2.3)	25 (3.5)	**70 (9.9)**
	Aware only	159 (22.4)	103 (14.5)	151 (21.3)	108 (15.2)	521 (73.4)
	Aware and used	41 (5.8)	40 (5.6)	13 (1.8)	25 (3.5)	119 (16.8)
	Total	217 (30.6)	155 (21.8)	180 (25.4)	158 (22.3)	710 (100)
Khan Academy	Not Aware	39 (5.5)	31 (4.4)	38 (5.4)	38 (5.4)	**146 (20.6)**
	Aware only	129 (18.2)	74 (10.4)	75 (10.6)	76 (10.7)	354 (49.9)
	Aware and used	49 (6.9)	50 (7)	67 (9.4)	44 (6.2)	210 (29.6)
	Total	217 (30.6)	155 (21.8)	180 (25.4)	158 (22.3)	710 (100)
Merlot	Not Aware	129 (18.2)	112 (15.8)	83 (11.7)	130 (18.3)	**454 (63.9)**
	Aware only	46 (6.5)	5 (0.7)	46 (6.5)	9 (1.3)	106 (14.9)
	Aware and used	42 (5.9)	38 (5.4)	51 (7.2)	19 (2.7)	150 (21.1)
	Total	217 (30.6)	155 (21.8)	180 (25.4)	158 (22.3)	710 (100)
Swayam	Not Aware	39 (5.5)	60 (8.5)	11 (1.5)	37 (5.2)	**147 (20.7)**
	Aware only	122 (17.2)	32 (4.5)	147 (20.7)	72 (10.1)	373 (52.5)
	Aware and used	56 (7.9)	63 (8.9)	22 (3.1)	49 (6.9)	190 (26.8)
	Total	217 (30.6)	155 (21.8)	180 (25.4)	158 (22.3)	710 (100)

Source: Researcher's Calculations based on Primary Data

Table 5.18 showed that: 'Not Aware' of OER by Institutions (26.6%), Wiki sources (9.9%), Khan Academy (20.6%), Merlot (63.9%), and Swayam (20.7%) only. The remaining respondents were aware of these OERs. The findings revealed that awareness about Wiki sources was more than other OERs.

Table 5.19: Awareness and usage of OER initiatives/Projects

Variables	Not Aware (1)	Aware Only (2)	Aware and used (3)	Mean	Std. Deviation	Variance	Rank
EPG Pathshala	141	332	237	2.14	0.718	0.515	**1**
NPTEL	132	354	224	2.13	0.697	0.485	**2**
YouTube	38	571	101	2.09	0.434	0.188	**3**
Khan Academy	146	354	210	2.09	0.703	0.494	**4**
Wikisources	70	521	119	2.07	0.512	0.262	**5**
Swayam	147	373	190	2.06	0.687	0.472	**6**
E-GYankosh	190	304	216	2.04	0.756	0.571	**7**
MOOCS	217	296	197	1.97	0.764	0.583	**8**
OER by Institutions	189	371	150	1.95	0.689	0.475	**9**
MIT	293	197	220	1.9	0.844	0.713	**10**
Sakshat	378	128	204	1.75	0.872	0.761	**11**
Connexions	400	84	226	1.75	0.907	0.823	**12**
NROER	462	56	191	1.62	0.881	0.775	**13**
Merlot	454	106	150	1.57	0.818	0.668	**14**

Source: Researcher's Calculations based on Primary Data

Table 5.19 has revealed that from the various OER initiatives available at national and international level, YouTube is the most popular OER platform and is used by majority of respondents (81.3%), and as per mean value 1.8535 it is ranked 1 as the

most widely used OER. It is followed by wiki sources (74.9%) respondents are aware of and have used and as per mean value 1.8648 it is ranked as 2. The responses recorded for Swayam are (52.5%), OERs provided by institution is (52.3%), NPTEL (49.0%), e-PG Pathshala (46.8%), E-Gyankosh (42.8%), and MOOCs (41.7%). In response to Not Aware about OER initiatives majority of respondents that is 65.2% were not aware about NROER (65.2%) followed by Merlot (63.7%), Connexions (56.3%), Sakshat (49.4%).

5.4.1 Purpose of using Open Educational Resources

The respondents were asked about their purpose of using OERs. The responses received about purpose of using OER are shown in **Table 5.20**. The results of responses show values of Writing Articles (61.1%), Prepare Class notes (84.4%), Research Projects (66.5%), General Knowledge (78.9%), Seminar/Conference Preparation (66.9%), for Comparing with Print (62.5%), Ideas and Inspirations (83%), and develop competencies (80.6%). The major responses have recorded 'Yes'.

Table 5.20: Institution wise responses about purpose of using OER by respondents

Purpose of using OER	Response	Central University of Haryana	Central University of Himachal Pradesh	Central University of Jammu	Central University of Punjab	Total
Writing Articles	No	94 (13.2)	71 (10)	49 (6.9)	62 (8.7)	**276 (38.9)**
	Yes	123 (17.3)	84 (11.8)	131 (18.5)	96 (13.5)	434 (61.1)
Prepare Class notes	No	31 (4.4)	42 (5.9)	21 (3)	17 (2.4)	**111 (15.6)**
	Yes	186 (26.2)	113 (15.9)	159 (22.4)	141 (19.9)	599 (84.4)
Research Projects	No	44 (6.2)	70 (9.9)	60 (8.5)	64 (9)	**238 (33.5)**
	Yes	173 (24.4)	85 (12)	120 (16.9)	94 (13.2)	472 (66.5)

Purpose of using OER	Response	Central University of Haryana	Central University of Himachal Pradesh	Central University of Jammu	Central University of Punjab	Total
General Knowledge	No	43 (6.1)	23 (3.2)	44 (6.2)	40 (5.6)	**150 (21.1)**
	Yes	174 (24.5)	132 (18.6)	136 (19.2)	118 (16.6)	560 (78.9)
Sem/ Conf. Preparation	No	55 (7.7)	78 (11)	41 (5.8)	61 (8.6)	**235 (33.1)**
	Yes	162 (22.8)	77 (10.8)	139 (19.6)	97 (13.7)	475 (66.9)
For Comparing with Print	No	94 (13.2)	55 (7.7)	48 (6.8)	69 (9.7)	**266 (37.5)**
	Yes	123 (17.3)	100 (14.1)	132 (18.6)	89 (12.5)	444 (62.5)
Ideas and Inspirations	No	34 (4.8)	21 (3)	31 (4.4)	35 (4.9)	**121 (17)**
	Yes	183 (25.8)	134 (18.9)	149 (21)	123 (17.3)	589 (83)
Develop Competencies	No	35 (4.9)	27 (3.8)	37 (5.2)	39 (5.5)	**138 (19.4)**
	Yes	182 (25.6)	128 (18)	143 (20.1)	119 (16.8)	572 (80.6)

Measure : Count (% of Total)

Source: Researcher's Calculations based on Primary Data

It means OERs are mostly used for educational purposes and as supplementary reading materials. The results also highlight that major purpose of using OERs by respondents is to prepare class notes (84.4%), followed by to get ideas and inspirations (83%), followed by to develop competencies (80.6%) and to obtain general knowledge (78.9%). The purpose of using OER was analysed both as per institution wise and as per category wise also. Table 5.22 shows the category wise responses about purpose of using OER.

Table 5.21: Category- wise responses about purpose of using OER by respondents

Purpose of using OER	Faculty	UG Students	PG Students	Research Scholars	Total	Mean	SD	Rank
To obtain General Knowledge	138	**129***	**251***	142	660	1.0720	.25875	1
To prepare class notes	129	129	237	136	631	1.1145	.31864	2
To improve professional competency	143*	103	234	145*	625	1.1228	.32848	3
To get new ideas and inspirations	140	110	228	140	618	1.1333	.34018	4
To prepare for seminar/ conferences	118	56	183	122	479	1.3338	.47192	5
To prepare for Research projects	120	50	192	116	478	1.3422	.47479	6
To compare them with already available printed resources	112	78	169	95	454	1.3804	.48584	7
To write Research articles	126	43	147	131	447	1.3856	.48710	8

(* the highest response within the category is shown in bold letters)

Source: Researcher's Calculations based on Primary Data

The purpose of using open educational resources differ from one category to another based on their general and specific requirements. The analysis and interpretation of responses collected related to purpose of using OERs has been presented in the Table 5.22.

Table 5.22: Analysis of Category- wise responses about purpose of using OER by respondents

category		Writing Articles	Prepare Class notes	Research Projects	General Knowledge	Sem/ Conf. Preparation	For Comparing with Print	Inspirations	Develop Competencies
Faculty	Mean	**1.81**	**1.81**	**1.80**	**1.83**	**1.79**	**1.73**	**1.93**	**1.87**
	Rank	**IV**	**IV**	**V**	**III**	**VI**	**VII**	**I**	**II**
	Std. Deviation	.392	.397	.402	.381	.412	.445	.251	.335
	% of Total Sum	23.6%	20.6%	22.7%	21.4%	22.4%	22.4%	22.2%	21.8%
	% of Total N	21.0%	21.0%	21.0%	21.0%	21.0%	21.0%	21.0%	21.0%
	Variance	.154	.158	.162	.145	.170	.198	.063	.112
UG students	Mean	**1.32**	**1.91**	**1.36**	**1.80**	**1.40**	**1.57**	**1.76**	**1.70**
	Rank	**VIII**	**I**	**VII**	**II**	**VI**	**V**	**III**	**IV**
	Std. Deviation	.467	.285	.482	.400	.493	.497	.426	.461
	% of Total Sum	15.6%	19.9%	15.7%	19.3%	16.1%	18.5%	18.5%	18.0%
	% of Total N	19.2%	19.2%	19.2%	19.2%	19.2%	19.2%	19.2%	19.2%
	Variance	.218	.081	.232	.160	.243	.247	.181	.212
PG students	Mean	**1.54**	**1.86**	**1.72**	**1.82**	**1.69**	**1.63**	**1.82**	**1.81**
	Rank	**VII**	**I**	**IV**	**II**	**V**	**VI**	**II**	**III**
	Std. Deviation	.499	.350	.452	.382	.465	.485	.382	.397
	% of Total Sum	35.9%	37.9%	38.7%	38.3%	38.0%	37.6%	37.5%	37.6%
	% of Total N	37.6%	37.6%	37.6%	37.6%	37.6%	37.6%	37.6%	37.6%
	Variance	.249	.123	.204	.146	.216	.235	.146	.157

category		Writing Articles	Prepare Class notes	Research Projects	General Knowledge	Sem/ Conf. Preparation	For Comparing with Print	Inspirations	Develop Competencies
Research Scholar	**Mean**	**1.80**	**1.80**	**1.72**	**1.68**	**1.76**	**1.58**	**1.80**	**1.84**
	Rank	**II**	**II**	**IV**	**V**	**III**	**VI**	**II**	**I**
	Std. Deviation	.403	.403	.453	.467	.429	.496	.403	.372
	% of Total Sum	24.8%	21.7%	22.9%	20.9%	23.5%	21.6%	21.9%	22.6%
	% of Total N	22.3%	22.3%	22.3%	22.3%	22.3%	22.3%	22.3%	22.3%
	Variance	.163	.163	.205	.218	.184	.246	.163	.138
Total	**Mean**	**1.61**	**1.84**	**1.66**	**1.79**	**1.67**	**1.63**	**1.83**	**1.81**
	Overall Rank	**VIII**	**I**	**VI**	**IV**	**V**	**VII**	**II**	**III**
	Std. Deviation	.488	.363	.472	.408	.471	.484	.376	.396
	% of Total Sum	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	% of Total N	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	Variance	.238	.132	.223	.167	.222	.235	.142	.157

Source: Researcher's Calculations based on Primary Data

Table 5.22 reveals that the purpose of using OER varies according to the category of respondents.

As per total mean value of 1.84 it is observed that the majority of respondents use OERs to prepare their class notes. It is followed by to get new ideas and inspirations at second preference with a mean value of 1.83; to develop professional competencies is the third major purpose of using OERs as per mean value 1.81, followed by to obtain general knowledge as per mean value 1.79, followed by preparing for seminars/conferences with mean value 1.67, to prepare for research projects rank as sixth among purposes as per mean value 1.66, for comparing with other printed sources at seventh rank as per mean value 1.63. To write research articles is at the eighth rank as per 1.61overall mean value.

The data was further studied in detail to see the Purpose of using OERs among the different categories of respondents. Table 5.22 revealed that most of the faculty use OERs to get new ideas and inspirations with a mean of 1.93, followed by to develop professional competencies as per mean value 1.87, followed by to obtain general knowledge as per mean value 1.83. Further, faculty members use OERs to write research articles and to prepare class notes with a mean value of 1.81, followed by to prepare research projects as per mean value 1.80, then followed by to prepare for seminars/conferences with 1.79 mean value, and at last to compare them with already available printed resources with 1.73 mean value.

Table 5.22 revealed that the major purpose of using OERs for UG students is to prepare class notes as the mean value of 1.91, followed by to obtain general knowledge with 1.80 mean, followed by to get new ideas and inspirations as mean value of 1.76, then to use it for developing their professional competencies as per mean 1.70, followed by to compare them with already available printed resources 1.57. The purpose of using OERs for research-based activities such as to prepare for seminar/ conferences (mean 1.40), to prepare research projects (mean 1.36) and to write articles, etc (mean 1.32) were least important for UG students may be due to the reason that UG students are not much involved in research activities and their major purpose of using OERs revolves around class curricula activities.

Further, while analyzing the purpose of using OERs for PG students' category, Table 5.22 revealed that similarly like UG students PG students also use OERs primarily to prepare their class notes as per mean value 1.86. Further, as per mean of 1.82, the second most important purpose for using OERs for PG Students is to obtain general knowledge and to get new ideas and inspirations as per mean of 1.81 which is followed by to improve professional competency may be due to the reason that most of the PG students prepare for their competitive exams and Job hunts, etc. To use OERs for preparing research projects is ranked as the fourth major purpose of using OERs for PG students, followed by preparing for seminars/ conferences. To compare it with printed resources and to use them for writing research articles are least preferred purpose for the PG student's category.

Table 5.22 revealed that the major purpose of using OERs for research scholars as per mean value 1.84 is to improve professional competencies, followed by to prepare research articles, class notes and to get new inspirations all three with the same mean value 1.80, followed by to prepare for seminar/conferences with mean value 1.76 and to prepare research projects as per mean value 1.72. Research scholars least preferred to use OERs to obtain general knowledge as per mean value 1.68 and to compare them with printed resources were the least important purpose of using OERs for research scholars as per 1.58 mean value.

5.4.2 Type of OERs more important to Users

There are many types and formats of OERs available over the Internet. The respondents were requested to rate importance of OER. The responses were recorded on a five-point Likert scale from Most Important to Not at all Important. The institution wise results are depicted in the Table 5.23.

The preference for using various OER is shown in **Table 5.23** below:

Table 5.23: Institution wise responses about types of OERs more important

OER	Scale	Central University of Haryana	Central University of Himachal Pradesh	Central University of Jammu	Central University of Punjab	Total
Open e-books	Most Important	128 (18)	74 (10.4)	116 (16.3)	78 (11)	396 (55.8)
	Important	72 (10.1)	45 (6.3)	34 (4.8)	61 (8.6)	212 (29.9)
	Sometimes Important	13 (1.8)	32 (4.5)	23 (3.2)	14 (2)	82 (11.5)
	Not at all Important	0 (0)	2 (0.3)	1 (0.1)	1 (0.1)	**4 (0.6)**
	Undecided	4 (0.6)	2 (0.3)	6 (0.8)	4 (0.6)	16 (2.3)
Open Audio/Video	Most Important	135 (19)	68 (9.6)	118 (16.6)	92 (13)	413 (58.2)
	Important	608 .5)	54 (7.6)	41 (5.8)	51 (7.2)	206 (29)
	Sometimes Important	16 (2.3)	27 (3.8)	11 (1.5)	11 (1.5)	65 (9.2)
	Not at all Important	3 (0.4)	5 (0.7)	5 (0.7)	2 (0.3)	**15 (2.1)**
	Undecided	3 (0.4)	1 (0.1)	5 (0.7)	2 (0.3)	11 (1.5)
Open Access Journals	Most Important	105 (14.8)	57 (8)	131 (18.5)	73 (10.3)	366 (51.6)
	Important	46 (6.5)	58 (8.2)	25 (3.5)	52 (7.3)	181 (25.5)
	Sometimes Important	61 (8.6)	35 (4.9)	15 (2.1)	18 (2.5)	129 (18.2)
	Not at all Important	1 (0.1)	4 (0.6)	1 (0.1)	1 (0.1)	**7 (1)**
	Undecided	4 (0.6)	0 (0)	8 (1.1)	14 (2)	26 (3.7)
Open Courses	Most Important	98 (13.8)	42 (5.9)	121 (17.1)	76 (10.7)	337 (47.6)
	Important	91 (12.9)	49 (6.9)	36 (5.1)	55 (7.8)	231 (32.6)
	Sometimes Important	20 (2.8)	48 (6.8)	14 (2)	15 (2.1)	97 (13.7)
	Not at all Important	4 (0.6)	15 (2.1)	2 (0.3)	1 (0.1)	**22 (3.1)**
	Undecided	4 (0.6)	0 (0)	6 (0.8)	11 (1.6)	21 (3)

OER	Scale	Central University of Haryana	Central University of Himachal Pradesh	Central University of Jammu	Central University of Punjab	Total
Blogs	Most Important	63 (8.9)	25 (3.5)	98 (13.8)	30 (4.2)	216 (30.5)
	Important	57 (8.1)	42 (5.9)	33 (4.7)	50 (7.1)	182 (25.7)
	Sometimes Important	72 (10.2)	59 (8.3)	31 (4.4)	54 (7.6)	216 (30.5)
	Not at all Important	16 (2.3)	28 (4)	4 (0.6)	9 (1.3)	**57 (8.1)**
	Undecided	8 (1.1)	1 (0.1)	13 (1.8)	15 (2.1)	37 (5.2)
Open Case Studies	Most Important	70 (9.9)	33 (4.7)	96 (13.5)	46 (6.5)	245 (34.6)
	Important	70 (9.9)	38 (5.4)	43 (6.1)	53 (7.5)	204 (28.8)
	Sometimes Important	26 (3.7)	48 (6.8)	22 (3.1)	45 (6.3)	141 (19.9)
	Not at all Important	43 (6.1)	35 (4.9)	6 (0.8)	2 (0.3)	**86 (12.1)**
	Undecided	7 (1)	1 (0.1)	13 (1.8)	12 (1.7)	33 (4.7)
Open Conference Proceedings	Most Important	79 (11.1)	37 (5.2)	98 (13.8)	43 (6.1)	257 (36.2)
	Important	72 (10.2)	31 (4.4)	37 (5.2)	65 (9.2)	205 (28.9)
	Sometimes Important	34 (4.8)	37 (5.2)	30 (4.2)	31 (4.4)	132 (18.6)
	Not at all Important	27 (3.8)	47 (6.6)	4 (0.6)	1 (0.1)	**79 (11.1)**
	Undecided	4 (0.6)	3 (0.4)	11 (1.6)	18 (2.5)	36 (5.1)

Measures : Count (% of Total)

Source: Researcher's Calculations based on Primary Data

An attempt was made to understand the preferred type of OERs by the respondents.

Table 5.23 showed the 'Not at all important' responses for Open e-books (0.6%), followed by Open Access Journals (1%), Open Audio/Video (2.1%), Open Courses (3.1%), Blogs (8.1%), Open Conference Proceedings (11.1%), and Open Case Studies (12.1%). The undecided responses ranged from 1.5% to 5.2% which is an insignificant number. The lot majority responses indicated most important, important

and sometimes important. The results showed that open audio/video were the most important OERs followed by open e-books.

Table 5.24. Category wise responses about Type of OERs more Important

Category		**Open e-books**	**Open Audio/Video**	**Open Access Journals**	**Open Courses**	**Blogs**	**Open Case Studies**	**Open Conf. Proc.**
Faculty	Mean	4.55	4.62	4.42	4.28	3.68	3.85	3.88
	Rank (Mean)	**II**	**I**	**III**	**IV**	**VII**	**VI**	**V**
	Std. Dev.	.683	.645	.790	.837	.988	1.075	1.046
	% of Total N	21.2%	21.1%	21.4%	21.3%	21.5%	21.5%	21.3%
UG students	Mean	4.56	4.67	3.83	4.14	3.68	3.42	3.22
	Rank(Mean)	**II**	**I**	**IV**	**III**	**V**	**VI**	**VII**
	Std. Dev.	.768	.597	1.199	1.114	1.230	1.156	1.232
	% of Total N	19.5%	19.5%	19.2%	19.7%	19.8%	19.8%	19.6%
PG students	Mean	4.53	4.63	4.02	4.11	3.61	3.73	3.79
	Rank(Mean)	**II**	**I**	**IV**	**III**	**VII**	**VI**	**V**
	Std. Dev.	.727	.656	1.041	1.009	1.137	1.238	1.189
	% of Total N	38.1%	38.2%	37.4%	38.3%	38.2%	37.9%	38.0%
Research Scholar	Mean	4.42	4.33	4.64	4.25	3.65	3.99	4.18
	Rank(Mean)	**II**	**III**	**I**	**IV**	**VII**	**VI**	**V**
	Std. Dev.	.864	.987	.758	.971	1.209	1.136	1.103
	% of Total N	21.3%	21.1%	22.0%	20.7%	20.5%	20.8%	21.0%
Total (Overall)	Mean	4.52	4.57	4.21	4.18	3.65	3.75	3.78
	Rank(Mean)	**II**	**I**	**III**	**IV**	**VII**	**VI**	**V**
	Std. Dev.	.757	.736	1.014	.990	1.139	1.180	1.190
	% of Total N	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Researcher's Calculations based on Primary Data

Table 5.24 revealed that open Audio/videos are more important to all categories of respondents as per mean value 4.57, it is followed by open e-books as second preferred OERs as per mean value 4.52, followed by open access journals as per mean value 4.21, followed by open courses as per mean value 4.18, followed by mean 3.78 for open conference proceedings, then followed by open case studies as per mean 3.75 and the least preferred OERs are Open Blogs as per 3.65 total mean value.

As shown in Table 5.24 and as per mean value and ranking between the categories revealed that Open Audios /Videos are the first choices of faculty, UG, and PG Students whereas for research scholars Open Access Journals are the first choice among different OERs. Open e-books are the second most important OERs for all the categories of respondents. Open Access Journals are the most important for Research scholars, for faculty, it is the third preferred OERs whereas for UG and PG students it is the fourth choice. Open Courses are the third important OERs for UG and PG students whereas for faculty and Research scholars open courses are the fourth choice among different types of OERs. Open Conference proceedings are the fifth important OERs for faculty, PG, and Research scholars whereas for UG students Open Conference proceedings are obviously the last choice. Open case studies are ranked as the sixth important OERs for all the categories of respondents. Open Blogs are the 5th choice for UG students whereas for all other categories it is ranked at 7 and the last choice among all other types of OERs.

5.5 Objective II: USER'S PERCEPTION, AWARENESS AND ATTITUDE TOWARDS OPEN EDUCATIONAL RESOURCES

The hypothesis under this objective has been developed in section number 1.12. So, this hypothesis is as shown below has been tested. In this section an attempt has been made to test the following hypothesis using SEM:

H_{03}: There is significant relationship between various constructs of OERs and Overall OERs Awareness.

5.5.1 Scale statistics of Variable of Constructs of Awareness and OER

In this section an attempt has been made to understand the structural relationship between awareness construct and various constructs of OER as shown in **Fig 5.1.** The reliability and validity of scale is tested with the help of SPSS 26.0 software. The results of scale rated on 3-point Likert scale (1=Not at all Aware, 2=Slightly Aware, 3=Fully Aware) statistics are shown in **Table 5.25** below:

Table 5.25 : Scale statistics of open educational resources and awareness

Variables	**Mean**	**Std. Deviation**
OER Awareness	**2.47**	0.558
OER Knowledge	2.35	0.633
CCL Awareness	**2.47**	0.500
e-PG Pathshala	2.28	0.718
NPTEL	2.15	0.699
Sakshat	2.23	0.868
e-Gyankosh	2.27	0.756
NROER	2.2	0.881
MOOCS	1.97	0.764
Connexions	1.75	0.907
MIT	1.94	0.828
YouTube	2.09	0.424
OER by Institutions	1.95	0.689
Wiki sources	2.05	0.498
Khan Academy	2.09	0.703
MERLOT	**1.57**	0.818
Swayam	2.06	0.687
Scale reliability (Cronbach's Alpha)=**0.787**; Item Means=2.03 N of variables=17; No. of Responses=710, Missing value=0, Item Variances=0.18 to 0.823;Inter-Item Correlations =-0.086 to 0.605; Scale=3-point Likert (1=Not at all Aware, 2=Slightly Aware, 3=Fully Aware		

Source: Researcher's Calculations based on Primary Data

Table 5.25 above shows that the scale has explained construct in the range of 52.33% to 82.33%, which is sufficient for conducting analysis in social sciences. The overall construct explained had a mean of 2.023 out of 3 resulting 67.4% construct explained by 17 variables. The variance is also less than 1. Inter-item correlation ranged from 0.086 to 0.605 and scale reliability coefficient (Cronbach's Alfa) is 0.787 which is higher than 0.6 and communality is more than 0.5. The skewness and Kurtosis values also fall within permissible limits of -2 to +2. These requirements significantly meet the criterion to apply structural equation modelling using AMOS (Hair et al., 2010). A structural path model was tested as shown in **Figure 5.1**.

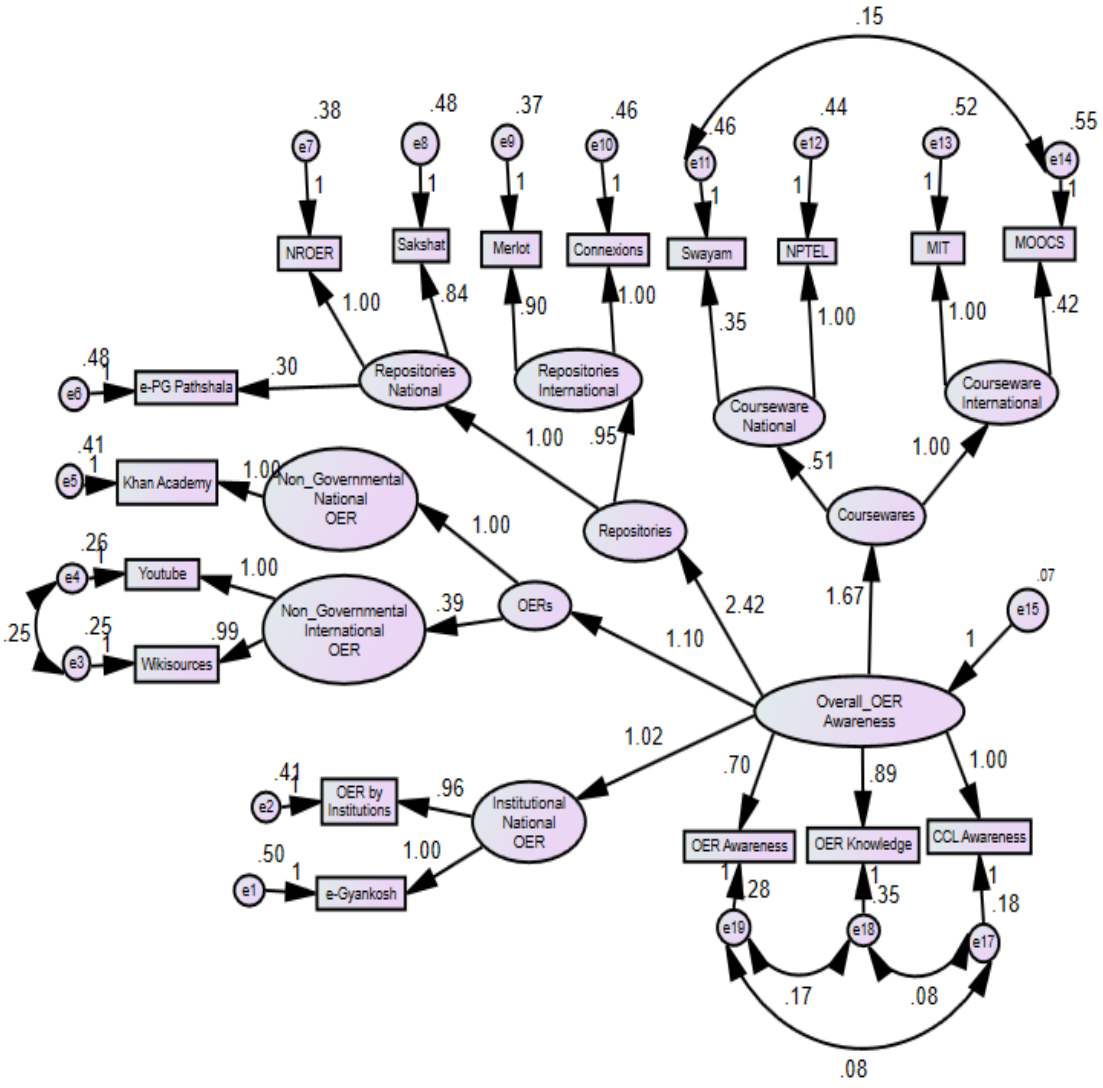

Figure 5.1: Structural relationship among OERs and awareness

Here, an attempt was made to produce a valid model using AMOS 4.0 version software widely used for structural equation modelling (SEM). All assumptions to use SEM like normal data, scale reliability, and correlation were found within limits. Here, it is pertinent to mention that this SEM has advantage over other techniques like regression where only one relationship can be tested. However, SEM has the ability to test multiple relationships simultaneously. Keeping in view the usefulness and appropriateness SEM was used for this analysis. The initial model was tested without correlation between various error terms. In multiple iterations a fit model is produced by correlating e3-e4, e11-e14, e17-e18, e17-e19, and e18-e19.

This correlation between various error terms was justified due to similarity to provide OER. The fit model results showed Chi-square = 531.24, Degrees of freedom = 114, and Probability level = .000. The results of fit indices shown in **Table 5.26** below are acceptable (Marsh and However, 1985, Cole, 1987; Marsh, Balla & McDonald, 1988; Bentler, 1990; Hair et al., 2010).

Table 5.26 : Fit indices of model between OERs and awareness

Model	NPAR	CMIN	DF	P (≤0.05)	CMIN/DF (≤5.0)	RMR (≥0.08)	RMSEA (≥0.08)	GFI (≥0.8)	AGFI (≥0.8	NFI Delta1 (≥0.8)	TLI rho2 (≥0.8)	CFI (≥0.8)
	39	531.24	53	0.00	4.6	0.035	0.07	0.902	0.870	0.895	0.899	0.914

Source: Researcher's Calculations based on Primary Data

The regression weights of structural path and level of significance is shown in **Table 5.27** below:

Table 5.27: Level of significance of structural paths between OERs and awareness

Structural Relations			Estimate	S.E.	C.R.	P	Label	Sig.
OERs	<---	Overall_OER_Awareness	1.098	.127	8.620	***	par_5	Yes
Repositories	<---	Overall_OER_Awareness	2.420	.196	12.342	***	par_6	Yes
Coursewares	<---	Overall_OER_Awareness	1.670	.164	10.207	***	par_7	Yes
Repositories_National	<---	Repositories	1.000					
Courseware_National	<---	Coursewares	.512	.072	7.073	***	par_3	Yes
Courseware_International	<---	Coursewares	1.000					
Non_Governmental_National_OER	<---	OERs	1.000					
Institutional_National_OER	<---	Overall_OER_Awareness	1.017	.133	7.658	***	par_4	Yes
Non_Governmental_International_OER	<---	OERs	.386	.082	4.710	***	par_11	Yes
Repositories_International	<---	Repositories	.954	.062	15.425	***	par_12	Yes
Wikisources (OER18)	<---	Non_Governmental_International_OER	.986	.034	29.116	***	par_1	Yes
Khan Academy (OER19)	<---	Non_Governmental_National_OER	1.000					
CCL Awareness (OER3)	<---	Overall_OER_Awareness	1.000					
e-PG Pathshala (OER8)	<---	Repositories_National	.300	.047	6.357	***	par_2	Yes

Structural Relations			**Estimate**	**S.E.**	**C.R.**	**P**	**Label**	**Sig.**
OER Knowledge (OER2)	<---	Overall_OER_Awareness	.889	.093	9.533	***	par_8	Yes
OER Awareness (OER1)	<---	Overall_OER_Awareness	.698	.082	8.550	***	par_9	Yes
YouTube (OER16)	<---	Non_Governmental_International_OER	1.000					
OER by Institutions (OER17)	<---	Institutional_National_OER	.959	.146	6.548	***	par_10	Yes
e-Gyankosh (OER11)	<---	Institutional_National_OER	1.000					
Sakshat (OER10)	<---	Repositories_National	.844	.059	14.305	***	par_13	Yes
NROER (OER12)	<---	Repositories_National	1.000					
MERLOT (OER20)	<---	Repositories_International	.902	.062	14.564	***	par_14	Yes
Connexions (OER14)	<---	Repositories_International	1.000					
NPTEL (OER9)	<---	Courseware_National	1.000					
Swayam (OER21)	<---	Courseware_National	.349	.134	2.611	.009	par_15	Yes
MIT (OER15)	<---	Courseware_International	1.000					
MOOCS (OER13)	<---	Courseware_International	.419	.076	5.485	***	par_16	Yes
Note : H_{03}: There is significant relationship between various constructs of OER and Overall OER Awareness is accepted								

Source: Researcher's Calculations based on Primary Data

As shown in **Table 5.27** that all structural paths are significant at 0.05 level resulting acceptance of H_{03}. The contribution of all OER towards overall awareness is revealed by calculating effect estimates. The Standardized Total Effects estimates are shown in **Table 5.27**. The Total Standardized Effects showed a standardized loading of 1 for OERs, Coursewares, Repositories, Repositories_International, Institutional_National_OER, Courseware_International, Courseware_National, Repositories_National, Non_Governmental_National_OER, and Non_Governmental_International_OER. As shown in **Fig. 5.1** the loading within a construct were fixed 1 for one variable to get comparative loading of other variables in the construct. The following are useful observations from Fig. 5.1:

1. **Institutional National OERs**: Under this construct e-Gyankosh loading was fixed to 1 and comparative loading of OERs by institution was 0.9. Here, e-Gyankosh is more important in imparting OERs as compared to OERs by institutions.

2. **Non-Governmental National OERs:** In this construct only Khan Academy was taken with loading of 1.

3. **Non-Governmental International OERs:** Under this construct the loading of YouTube was fixed (1) and comparative loading of Wiki sources (0.99) showed nearly equal comparative rating.

4. **OERs:** Under this construct loading showed Non-Governmental National OER (1.0) and Non-Governmental International OER (0.39). It showed that Non-Governmental National OER contribute higher to OERs as compared to Non-Governmental International OER.

5. **Repositories National:** Under this construct the loadings of NROER (1), e-PGPathshala (0.3), and Sakshat (0.84) revealed their relative contribution towards repositories at the national level.

6. **Repositories international:** In this construct the loading of Connexions was fixed at 1 and relative loading of MERLOT showed 0.9. Here, loadings showed more weightage for Connexions.

7. **Repositories:** Here, the loadings for Repositories National was fixed at 1 and loadings for Repositories International showed loadings of 0.95. The loadings show their relative importance on this construct.

8. **Coursewares National:** Here, loadings of NPTEL (1.0) showed much higher weightage as compared to SWAYAM (0.35).

9. **Coursewares International:** Here, loadings of MIT (1.0) showed much higher weightage as compared to MOOCS (0.41).

10. **Overall OER Awareness with its variables:** Under this constructs the variable showed loadings of CCL Awareness fixed at 1.0, followed by OER Knowledge (0.89), and OER Awareness (0.7).

11. **Overall OER Awareness with other constructs:** Here, the loadings showed that Repositories had the most contribution followed by Courseware, OERs, and Institutional National OERs.

The results also showed that these constructs significantly contribute to overall awareness of OERs. The Total Effects **Table 5.28** of various OER showed total effects as MOOCS (0.239), e-PG Pathshala (0.264), OER Awareness (0.326), OER Knowledge (0.366),CCL Awareness (0.521), Wikisources (0.213), Youtube (0.212), Khan Academy (0.407), NPTEL (0.320), SWAYAM (0.113), MIT (0.515), OER by Institutions (0.368), e-Gyankosh (0.350), Connexions (0.663), MERLOT (0.663),Sakshat (0.610), and NROER (0.716) showed positive association between these variables and Overall OER Awareness.

Table 5.28: Standardized effect estimates of awareness and open educational resources

Constructs/ Variables	Overall_OER_Awareness		
	Total Effect	Direct Effect	Indirect Effect
	Overall_OER_Awareness	Overall_OER_Awareness	Overall_OER_Awareness
OERs	1.000	1.000	.000
Coursewares	1.000	1.000	.000
Repositories	1.000	1.000	.000
Repositories_International	1.000	.000	1.000
Institutional_National_OER	1.000	1.000	.000
Courseware_International	1.000	.000	1.000
Courseware_National	1.000	.000	1.000
Repositories_National	1.000	.000	1.000
Non_Governmental_National_OER	1.000	.000	1.000
Non_Governmental_International_OER	1.000	.000	1.000
MOOCS (OER13)	.239	.000	.239
e-PG Pathshala (OER8)	.264	.000	.264
OER Awareness (OER1)	.326	.326	.000
OER Knowledge (OER2)	.366	.366	.000
CCL Awareness (OER3)	.521	.521	.000
Wikisources (OER18)	.213	.000	.213
YouTube (OER16)	.212	.000	.212
Khan Academy (OER19)	.407	.000	.407
NPTEL (OER9)	.320	.000	.320
Swayam (OER21)	.113	.000	.113
MIT (OER15)	.515	.000	.515
OER by Institutions (OER17)	.368	.000	.368
e-Gyankosh (OER11)	.350	.000	.350
Connexions (OER14)	.663	.000	.663
MERLOT (OER20)	.663	.000	.663
Sakshat (OER10)	.610	.000	.610
NROER (OER12)	.716	.000	.716

Source: Researcher's Calculations based on Primary Data

5.5.2 Recommendations and Suggestions for Future Research

The Repositories have the maximum contribution towards overall OERs awareness followed by Coursewares, OERs, and Institutional National OERs. The National Repositories and compatible with International Repositories. The International Courseware are considered much better than National Courseware. The Non-Governmental National OERs are much better than Non-Governmental International OERs. The strategists and policy makers need to focus on the limiting areas to OERs for benefit of users.

It is suggested to conduct future research covering wide range of educational institutions across the country. The chances are there that reputation, accreditations, funding pattern, geographical location, and infrastructure shall also impact availability and access of OER. Also, there is a need to develop a culture of self-learning and thinking out of box to match OERs offered with interest and needs of users for better future prospects. Finally, there is a need to benchmark OER strategy to not only to gain international market share but also in the best interest of humanity across the globe.

5.6 Objective III: PURPOSE AND EXTENT OF USING OER

In this section the main focus was to explore the purpose of using educational resources and the extent of the use of provided resources. The basic purposes of using OER was revealed with the help of strong literature support in consultation of practitioners and researchers. In this section the following hypothesis was tested:

H_{04}: There is a significant relation between OER_Purpose and OER_Extent

The questionnaire was tested through pre-pilot and pilot survey. Later, large scales survey was done and results of scale statistics of purpose of using OER are shown in **Table 5.29** below:

Table 5.29: Scale statistic of purpose of using open educational resources

Statistical values		Writing Articles	Prepare Class Notes	Research Projects	General Knowledge	Seminar/Conference Preparation	For Comparing with Print	Inspirations	Develop Competencies
N	Valid	710	710	710	710	710	710	710	710
	Missing	0	0	0	0	0	0	0	0
Responses	Yes (%)	434 (61.1)	599 (84.4)	472 (66.5)	560 (78.9)	475 (66.9)	444 (62.5)	589 (83)	572 (80.6)
	No (%)	276 (38.9%)	111 (15.6)	238 (33.5)	150 (21.1)	235 (33.1)	266 (37.5)	121 (17)	135 (19)
	Rank (Yes)	**VIII**	**I**	**VI**	**IV**	**V**	**VII**	**II**	**III**
Std. Error of Mean		.018	.014	.018	.015	.018	.018	.014	.015
Std. Deviation		.488	.363	.472	.408	.471	.484	.376	.410
Variance		.238	.132	.223	.167	.222	.235	.142	.168
Range		1	1	1	1	1	1	1	2
Minimum		1	1	1	1	1	1	1	1
Maximum		2	2	2	2	2	2	2	3

Source: Researcher's Calculations based on Primary Data

Table 5.29 above has revealed the ranking of YES responses to use OER on the YES and No ratings. The ranks have revealed that 1st preference of respondents was to use OER for preparing class notes (84.4%) followed by Inspirations (83%), Develop Competencies (80.6%), General Knowledge (78.9%), Seminar/Conference Preparation (66.9%), Research Projects (66.5%), For Comparing with Print (62.5%), and Writing Articles (61.1%).

The results were tested by proposing a relationship between the purpose of using OER and OER Extent. Four variables were selected under extent construct. These include OER Awareness, OER Knowledge, OER Source, and OER Frequency. All these variables under OER purpose and OER Extent were rated on a ***3-point Likert***

scale to develop, test and validate a structural model. The proposed structural model is shown in **Figure 5.2** below:

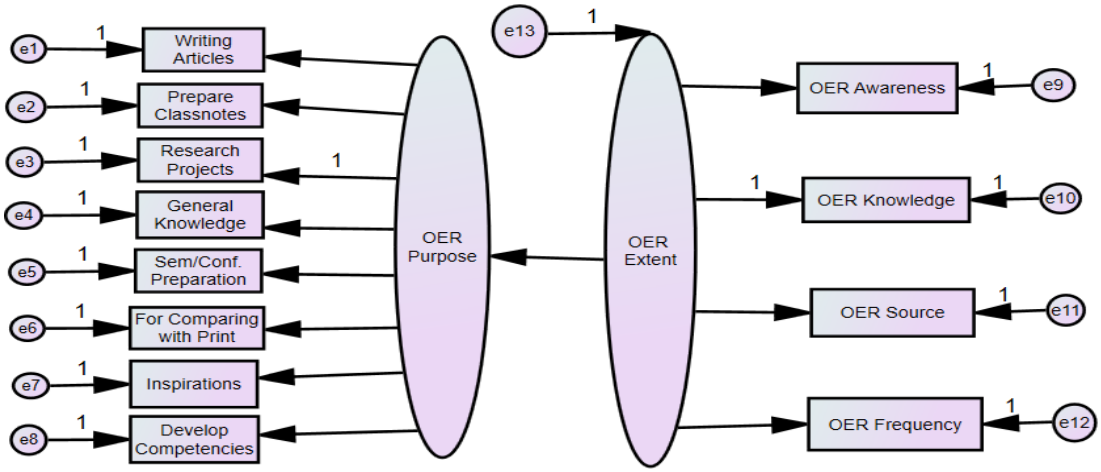

Figure 5.2 : Proposed structural model of purpose and extent of using OER

The proposed model was tested using AMOS 4.0 version with maximum likelihood chi-square test of model fit and the parameter estimates and results were produced as shown in **Figure 5.3** and **Table 5.30** hereunder:

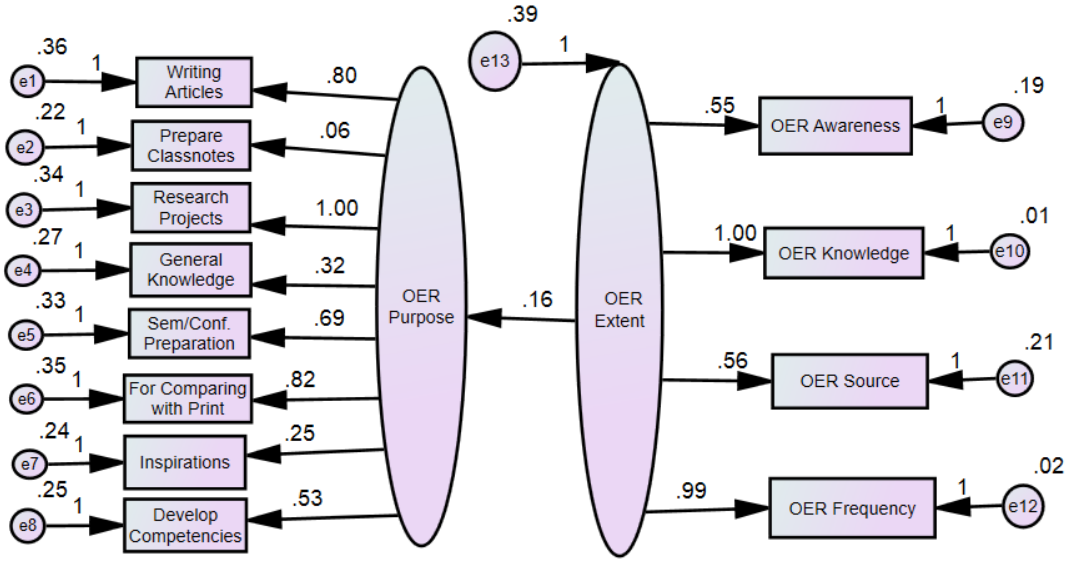

Figure 5.3 : Results of proposed structural model for purpose and extent of OER

The proposed model was not fit as shown in **Table 5.30** because the statistical indices were not statistically significant.

Table 5.30: Fit indices for purpose and extent of Open Educational Resources

Model	NPAR	CMIN	DF	P	CMIN/DF	RMR	RMSEA
Default model	24	1854.314	54	.000	34.339	0.029	0.217

Source: Researcher's Calculations based on Primary Data

Here, it is pertinent to mention that CMIN/DF must be less than or equal to 5 to justify reasonable fit model (Marsh and Hocevar, 1985). While AGFI, GFI, NFI, and NNFI must be greater than or equal to 0.9 for good fit and NFI < 0.9; 0.85 < GFI, and 0.8 < AGFI < 0.9 show acceptable fit model (Cole, 1987; Marsh, Balla& McDonald, 1988; Bentler, 1990). Root-mean-square residual (RMR) and Root mean square error of approximation (RMSEA) must be less than or equal to 0.08 (Hair et al., 2010).

This model was modified using modification index which showed the correlation between e9 and e11. It has justified that the correlation exists due to the close association between these constructs. It was well known that inspiration was associated with development of competencies and awareness was closely associated with knowledge. The correlation between these variables based on Modification index produced a fit model as shown in **Figure 5.4**. The results of fit indices are shown in **Table 5.31**.

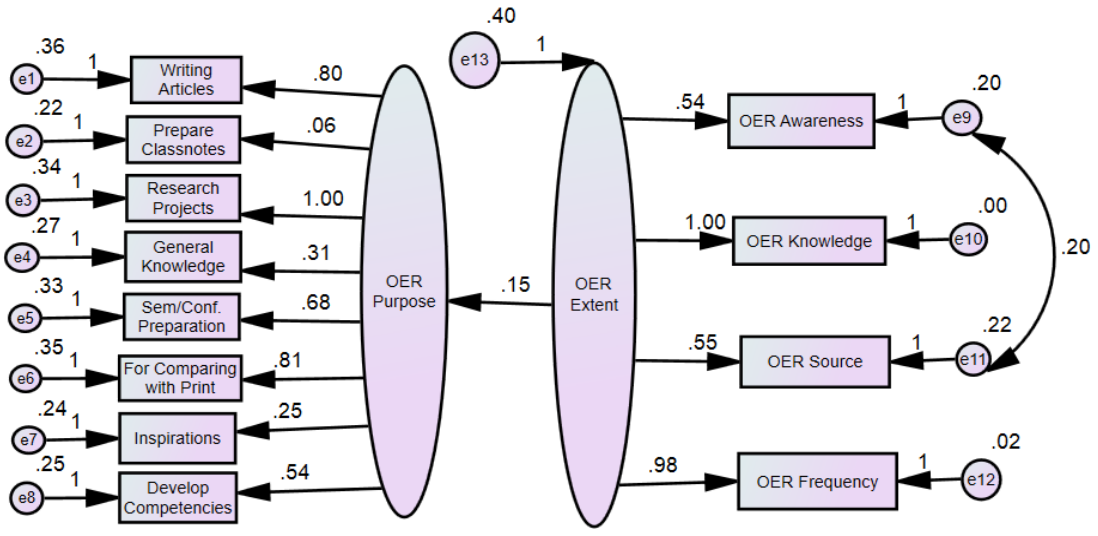

Figure 5.4: Results of fit structural model for purpose and extent of OER

The fit model results showed Chi-square = 198.760, Degrees of freedom = 53, and Probability level = .000. The results of fit indices shown in Table below are acceptable (Marsh and However, 1985, Cole, 1987; Marsh, Balla& McDonald, 1988; Bentler, 1990; Hair et al., 2010).

Table 5.31: Fit indices for proposed model between purpose and extent of OER

NPAR	CMIN	DF	P (≤0.05)	CMIN/DF (≤5.0)	RMR (≥0.08)	RMSEA (≥0.08)	GFI (≥0.8)	AGFI (≥0.8	NFI Delta1 (≥0.8)	TLI rho2 (≥0.8)	CFI (≥0.8)
25	198.760	53	0.00	3.75	0.019	0.062	0.954	0.933	0.957	0.960	0.968

Source: Researcher's Calculations based on Primary Data

The regression weights of structural path and level of significance is shown in **Table 5.32** below:

Table 5.32: Results of proposed path model between purpose and extent of OER

Structural Path			Estimate	S.E.	C.R.	P	Label	Remarks
OER_Purpose	**<---**	**OER_Extent**	.154	.035	4.380	***	par_3	Significant
P7	<---	OER_Purpose	.248	.197	1.255	.209	par_1	**Not Significant**
OER6	<---	OER_Extent	.980	.014	68.443	***	par_2	Significant
P1	<---	OER_Purpose	.796	.297	2.680	.007	par_4	Significant
P2	<---	OER_Purpose	.056	.184	.303	.762	par_5	**Not Significant**
P3	<---	OER_Purpose	1.000					
P4	<---	OER_Purpose	.310	.214	1.445	.148	par_6	**Not Significant**
P5	<---	OER_Purpose	.682	.274	2.490	.013	par_7	Significant
P6	<---	OER_Purpose	.811	.297	2.735	.006	par_8	Significant
P8	<---	OER_Purpose	.538	.231	2.328	.020	par_9	Significant
OER5	<---	OER_Extent	.546	.028	19.161	***	par_10	Significant
OER2	<---	OER_Extent	1.000					
OER1	<---	OER_Extent	.539	.027	19.885	***	par_11	Significant
H_{04}: There is a significant relation between OER_Purpose and OER_Extent is accepted								

Source: Researcher's Calculations based on Primary Data

The results (**Table 5.32**) revealed the insignificant relations for "OER Frequency Inspirations (P7)<---OER_Purpose construct, Prepare Class Notes (P2)<---OER_Purpose construct, and General Knowledge (P4)<---OER_Purpose construct. However, there was significant relation between **OER_Purpose<---OER_Extent** resulting acceptance of H_{04}.The reasons for this lack of links shall be due to insufficiency of infrastructure for exploring OER. Here, strategists, practitioners and policy makers need to pay more attention for better access of OER. The results were further refined using Total, Direct and Indirect effects as shown in **Table 5.33** below:

Table 5.33: Effects of proposed model between purpose and extent of OER

Effects	Constructs	Purpose	OER Frequency (OER6)	OER Source (OER5)	OER Knowledge (OER2)	OER Awareness (OER1)	Writing Articles (P1)	Prepare Classnotes (P2)	Research Projects (P3)	General Knowledge (P4)	Sem/Conf. Preparation (P5)	For Comparing with Print (P6)	Inspirations (P7)	Develop Competencies (P8)
Total Effect	OER_Extent	**.154**	**.980**	**.546**	**1.0**	**.539**	**.122**	**.009**	**.154**	**.048**	**.105**	**.125**	**.038**	**.083**
	Purpose	0	0	0	0	0	.796	.056	1.0	.310	.682	.811	.248	.538
Direct Effect	OER_Extent	.154	.980	.546	1.0	.539	0	0	0	0	0	0	0	0
	Purpose	0	0	0	0	0	.796	.056	1.0	.310	.682	.811	.248	.538
Indirect Effect	OER_Extent	0	0	0	0	0	.122	.009	.154	.048	.105	.125	.038	.083
	Purpose	0	0	0	0	0	0	0	0	0	0	0	0	0

Source: Researcher's Calculations based on Primary Data

The Total effect, which are sum of Direct Effect and Indirect Effect (Sobel, 1982, 1986), are helpful to know the loading (positive or negative association) of variables on the constructs and between constructs (FOX, J. 1985). **Table 5.33** above shows that increase in OER_Extent results in increase in purpose and all variables within it and variables of Purpose construct. However, due to direction from OER_Extent→Purpose the association either positive or negative of Total Effect is not visible showing zeros for Total Effect of Purpose on various variables of

OER_Extent. However, the purpose construct showed positive association with all variables within its group.

5.7 Objective IV: MOTIVATIONS AND CONSTRAINTS IN THE USE OF OER

The major motivations taken in this study include: OER Learning Suitability; OER Makes Learning Easy; OER Reliable Contents; OER Improves Academic Performance; OER Saves Money; OER Reduces Photocopy Cost; OER Provides Wide Literature; OER Quality Standards; OER Usability; and OER Promotes Collaboration. These were taken with strong literature support and in consultation of practitioners and researchers. Under this objective a systematic procedure was adopted to analyze data. The normality was tested as shown in **Table 5.34** below:

Table 5.34 : Skewness, Kurtosis and range statistics of motivators of open educational resources

Statistical measures		**OER Learning Suitability**	**OER Makes Learning Easy**	**OER Reliable Contents**	**OER Improves Academic Performance**	**OER Saves Money**	**OER Reduces Photocopy Cost**	**OER Provides Wide Literature**	**OER Quality Standards**	**OER Usability**	**OER Promotes Collaboration**
N	Valid	710	710	710	710	710	710	710	710	710	710
	Missing	0	0	0	0	0	0	0	0	0	0
Std. Error of Mean		.025	.026	.032	.028	.033	.037	.036	.031	.030	.033
Std. Deviation		.674	.701	.850	.734	.876	.988	.969	.837	.795	.868
Variance		.455	.491	.722	.539	.767	.976	.938	.700	.632	.754
Skewness		-.758	-.815	-.856	-.840	-.930	-.943	-.703	-.904	-1.03	-.82
Std. Error of Skewness		.092	.092	.092	.092	.092	.092	.092	.092	.092	.092
Kurtosis		.833	1.171	.412	.803	.648	.131	.098	.820	1.506	.384
Std. Error of Kurtosis		.183	.183	.183	.183	.183	.183	.183	.183	.183	.183
Range		4	4	4	4	4	4	4	4	4	4
Minimum		1	1	1	1	1	1	1	1	1	1
Maximum		5	5	5	5	5	5	5	5	5	5

Source: Researcher's Calculations based on Primary Data

The results regarding Skewness, Kurtosis and range statistics of motivations of open educational resources showed acceptable values within the range of +2 to -2 both for skewness, +7 to -7 for Kurtosis (Hair et al., 2010). The range values showed the use of 5-point Likert scale. The decision variable selected were also analysed for scale reliability and validity as shown in **Table 5.35**.

Table 5.35 : Scale statistics of motivators of open educational resources

Variables	**Mean**	**Std. Deviation**
OER Learning Suitability	4.30	.674
OER Makes Learning Easy	4.25	.701
OER Reliable Contents	4.18	.850
OER Improves Academic Performance	4.24	.734
OER Saves Money	4.13	.876
OER Reduces Photocopy Cost	4.11	.988
OER Provides Wide Literature	3.91	.969
OER Quality Standards	4.15	.837
OER Usability	4.21	.795
OER Promotes Collaboration	4.15	.868
Cronbach's Alpha=0.856, Sample Size=710, No. of variables=10		

Source: Researcher's Calculations based on Primary Data

As shown in **Table 5.35** above the 10 variables were selected for evaluating motivations for the use of open educational resources. The scale reliability coefficient (Cronbach's Alpha=0.856) showed statistically significant scale reliability as its value was greater than 0.6 (Hair et al., 2010) for a sample size of 710 with no missing values. The mean, variance and inter-item correlations are shown in **Table 5.36 below**:

Table 5.36 : The mean, variance and inter-item correlations of motivators of open educational resources

Statistical Measure	Mean	Mini.	Maxi.	Range	Maxi./ Mini.	Variance	N of Items
Item Means	4.165	3.908	4.304	.396	1.101	.012	10
Item Variances	.697	.455	.976	.521	2.146	.031	10
Inter-Item Correlations	.385	.122	.633	.512	5.213	.007	10

Source: Researcher's Calculations based on Primary Data

Table 5.36 above shows the mean of 4.165 on 5-point Likert scale explaining 83.3% of the construct validity. Also, the inter-item correlation justified the association between variables justifying criterion validity (Hair et al., 2010). The association was further explored using communality using Principal Component Analysis as shown in **Table 5.37** below:

Table 5.37: Communality, KMO, and Test of Sphericity of motivators for open educational resources

Variables	Initial	Extraction
OER Learning Suitability	1.000	.683
OER Makes Learning Easy	1.000	.620
OER Reliable Contents	1.000	.504
OER Improve Academic Performance	1.000	.563
OER Saves Money	1.000	.589
OER Reduces Photocopy Cost	1.000	.758
OER Provides Wide Literature	1.000	.511
OER Quality Standards	1.000	.501
OER Usability	1.000	.548
OER Promotes Collaboration	1.000	.500
Kaiser-Meyer-Olkin Measure of Sampling Adequacy(KMO)=0.881; Bartlett's Test of Sphericity (Approx. Chi-Square=2440.078, Df=45,Sig.=.000)		

Source: Researcher's Calculations based on Primary Data

The results shown in the above **Table 5.37** revealed acceptable values for KMO (≥0.6), the level of significance (≤0.05) and communality above (0.5). All these statistical values (**Table 5.36 & 5.37**) showed the assumptions and requirements met to proceed with factor analysis. Factor analysis was done with the help of SPSS 26.0 using Principal Component Analysis and Varimax rotation with Kaiser Normalization. The results are shown in **Table 5.38** below:

Table 5.38 : Factor analysis results of motivators of open educational resources

Motivators	**Component**	
	1	**2**
OER Reduces Photocopy Cost	.870	
OER Saves Money	.720	
OER Usability	.658	
OER Reliable Contents	.583	
OER Promotes Collaboration	.572	
OER Learning Suitability		.794
OER Makes Learning Easy		.736
OER Provides Wide Literature		.710
OER Improves Academic Performance		.641
OER Quality Standards		.526
% Variance(cumulative)	**44.857(44.857)**	**10.848 (55.705)**
Eigen Values	**4.486**	**1.085**

Source: Researcher's Calculations based on Primary Data

As shown in **Table 5.38** above, two factors were extracted. These are explained as follow:

5.7.1 Factor 1(Financial factor)

This factor has extracted five variables as a group namely; OER Reduces Photocopy Cost, OER Saves Money, OER Usability, OER Reliable Contents, and OER Promotes Collaboration. The loading in this group ranges from 0.870 to 0.572. This factor was most important explaining 44.857% construct and an Eigen value of 4.486. The results are in consonance with the studies produced by (Bliss et al., 2013; Mitchell and Chu, 2014; Mtebe and Raisamo, 2014; Pounds & Bostock, 2019). Belikov and Bodily (2016) also revealed in their study that the faculty expressed their willingness to explore open education resources due to cost and pedagogical benefits for their students.

5.7.2 Factor 2 (Academic Factor)

This factor has also extracted five variables as a group namely; OER Learning Suitability, OER Makes Learning Easy, OER Provides Wide Literature, OER Improves Academic Performance, and OER Quality Standards. The loading in this group ranges from 0.794 to 0.526. This factor was 2nd most important explaining 10.848% construct and an Eigen value of 1.085. The results are in consonance with the studies produced by (Appiah et al., 2020; Hussain et al., 2013; Shukla, 2015; Perryman & Seal, 2016.) Kumar Upneja (2020) also revealed the same where users responded that they have gained access to best resources by using OERs, they got supplementary reading materials and they get flexible and lifelong learning as a benefit of using open educational resources.

The grouping of these variables will help the strategists to manage and develop policies for the betterment of these services. It is due to the fact that clubbing variables based on their similarity shall help to develop a uniform procedure and policy to cope with the problems faced by the service providers. It was also used to understand the structural relationship between motivators and constraints. The major constraints or barriers in the OER are discussed in the next section.

5.7.3 Constraints in using Open Educational Resources

In this section the data was analysed and scale was validated using various statistical indicators as explained in the previous section. The results are shown in **Tables 5.39 & 5.40.**

Table 5.39 : Skewness, Kurtosis and range statistics of constraints of open educational resources

		Time to Find OER	Interest in OER	Institutional Support	Copy Rights Issues	Language Barrier	Subject Related Resources	Healt Hazards
N	Valid	710	710	710	710	710	710	710
	Missing	0	0	0	0	0	0	0
Std. Error of Mean		.044	.042	.043	.038	.045	.042	.048
Std. Deviation		1.170	1.117	1.137	1.003	1.198	1.120	1.290
Variance		1.369	1.248	1.292	1.006	1.434	1.255	1.663
Skewness		.057	.196	.294	-.653	.346	.367	.385
Std. Error of Skewness		.092	.092	.092	.092	.092	.092	.092
Kurtosis		-1.337	-.951	-1.030	-.250	-1.059	-.936	-.994
Std. Error of Kurtosis		.183	.183	.183	.183	.183	.183	.183
Range		4	4	4	4	4	4	4
Minimum		1	1	1	1	1	1	1
Maximum		5	5	5	5	5	5	5

Source: Researcher's Calculations based on Primary Data

In the above **Table 5.40** the Skewness and Kurtosis are acceptable for assumption of normal probability distribution of data (Hair et al., 2010). The scale mean, standard deviation, Cronbach's Alpha, KMO, and Bartlett's Test of Sphericity are shown in **Table 5.40** below:

Table 5.40 : Scale statistics of constraints of open educational resources

Constraints	Mean	Std. Deviation
Time to Find OER	3.24	1.170
Interest in OER	2.99	1.117
Institutional Support	2.99	1.137
Copy Rights Issues	3.63	1.003
Language Barrier	2.99	1.198
Subject Related Resources	2.90	1.120
Health Hazards	2.73	1.290
Cronbach's Alpha=0.788, No. of variables=7, Sample Size=710, Item Means=3.068, Inter-Item Correlations range= (0.103 to 0.551), Kaiser-Meyer-Olkin Measure of Sampling Adequacy=0.809; Bartlett's Test of Sphericity=(Approx. Chi-Square=1349.893, Df=21,Sig.=.000)		

Source: Researcher's Calculations based on Primary Data

The item means of 3.068 on a 5-point Likert scale showed 61.4% construct agreement. The communalities were also calculated before conducting Factor Analysis (**Table 5.41**). The results of communalities had fallen within the acceptable range 0.5 to 0.698 which are statistically significant for conducting Factor Analysis (Hair et al., 2010).

Table 5.41: Communalities of constraints in using open educational resources

Constraints	Initial	Extraction
Time to Find OER	1.000	.693
Interest in OER	1.000	.615
Institutional Support	1.000	.634
Copy Rights Issues	1.000	**.500**
Language Barrier	1.000	**.698**
Subject Related Resources	1.000	.571
Health Hazards	1.000	.535

Source: Researcher's Calculations based on Primary Data

As shown in **Tables 5.40** and **5.41** above all requirements for applying factor analysis were met. Factor analysis was done with the help of SPSS 26.0 using Principal Component Analysis and Varimax rotation with Kaiser Normalization. The results are shown in **Table 5.42** below:

Table 5.42: Factor analysis results of constraints of open educational resources

Constraints	Component	
	1	**2**
Time to Find OER	.831	
Institutional Support	.794	
Interest in OER	.703	
Subject Related Resources	.631	
Language Barrier		.781
Copy Rights Issues		.684
Health Hazards		.667
% Variance(cumulative)	44.896(44.896)	15.343(60.239)
Eigen Values	3.143	1.074

Source: Researcher's Calculations based on Primary Data

As shown in **Table 5.42** above, two factors were extracted. These are explained as follow:

5.7.3.1 Factor 1 (Individual Factors) : This factor has extracted four variables as a group namely; Time to Find OER, Institutional Support, Interest in OER, and Subject Related Resources. The loading in this group ranges from 0.831to 0.631. This factor was most important explaining 44.896% construct and an Eigen value of 3.143. The results are in consonance with the studies produced by (Belikov and Bodily, 2016; Kumar et al., 2021; Rao Baikady and Mudhol, 2011; Singh and Gupta, 2020; Sohail and Alvi, 2013; van der Merwe, 2015)

5.7.3.2 Factor 2 (Other Factors) : This factor has also extracted three variables as a group namely; Language Barrier, Copy Rights Issues, and Health Hazards. The loading in this group ranges from 0.781to 0.667. This factor was most important explaining 10.848% construct and an Eigen value of 1.085. The results are in consonance with the studies produced by (Akparobore and Omosekejimi, 2020; Chen and Panda, 2013; Pounds and Bostock, 2019; Thandavamoorthy, 2011).

The grouping of these variables shall help the strategists to manage and develop policies for the betterment of these services. It is due to the fact that clubbing variables based on their similarity shall help to develop a uniform procedure and policy to cope with the problems faced by the service providers. It was also used to understand the structural relationship among motivators and constraints. The major constraints or barriers in the OER are discussed in the next section. A fit model was produced to know structural relationships among motivations and constraints. Here, many models were tested using AMOS 4.0 and finally a perfect fit model was found by removing "Copy Rights Issues" in the structural form as shown in Figure 5.5 below.

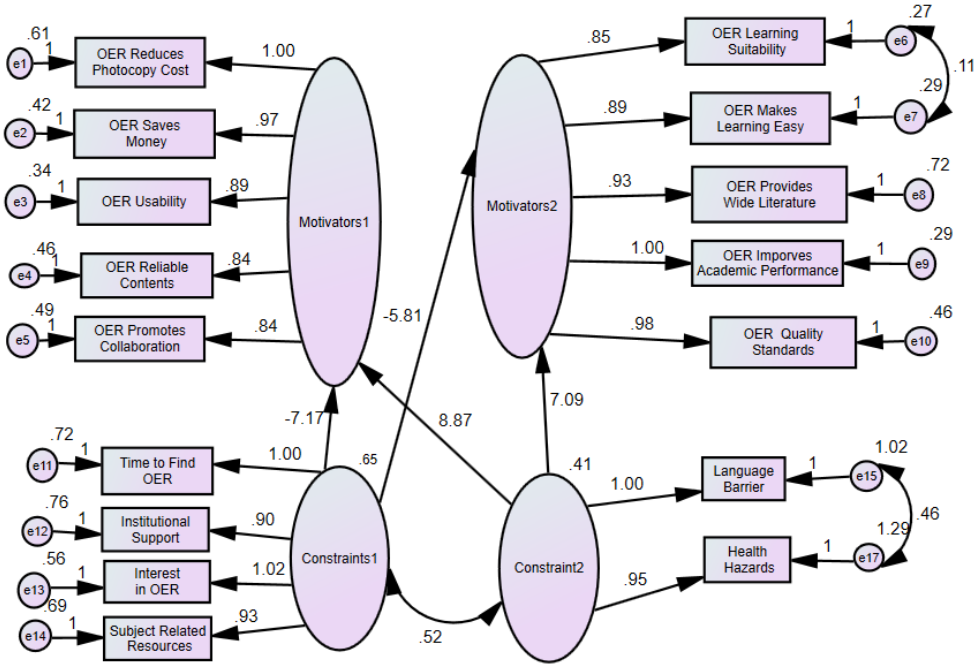

Figure 5. 5: Structural fit model of constraints and motivators of open educational resources

The 'Copy Rights Issues' constraint was eliminated to produce a fit model. The fit model results showed Chi-square = 473.891, Degrees of freedom = 99, and Probability level = .000. The results of fit indices shown in **Table 5.43** below are acceptable (Marsh and However, 1985, Cole, 1987; Marsh, Balla and McDonald, 1988; Bentler, 1990; Hair et al., 2010).

Table 5.43: Fit indices for structural model between motivators and constraints of OER

Model	NPAR	CMIN	DF	P (≤0.05)	CMIN/DF (≤5.0)	RMR (≥0.08)	RMSEA (≥0.08)	GFI (≥0.8)	AGFI (≥0.8	NFI Delta1 (≥0.8)	TLI rho2 (≥0.8)	CFI (≥0.8)
	37	473.891	99	0.00	4.78	0.05	0.07	0.921	0.880	0.879	0.88	0.901

Source: Researcher's Calculations based on Primary Data

The regression weights of structural path and level of significance is shown in **Table 5.44** below.

Table 5.44: Results of proposed path model between motivators and constraints of OER

Path			Estimate	S.E.	C.R.	P	Label	Remarks
Motivators1	<---	Constraints1	-7.175	4.217	-1.701	.089	par_3	**Not Significant**
Motivators2	<---	Constraint2	7.090	4.269	1.661	.097	par_5	**Not Significant**
Motivators2	<---	Constraints1	-5.810	3.374	-1.722	.085	par_6	**Not Significant**
Motivators1	<---	Constraint2	8.866	5.336	1.662	.097	par_7	**Not Significant**
OER Reduces Photocopy Cost (M6)	<---	Motivators1	1.000					
OER Usability (M9)	<---	Motivators1	.885	.062	14.268	***	par_1	Significant
Time to Find OER (C1)	<---	Constraints1	1.000					Significant
Institutional Support (C3)	<---	Constraints1	.903	.063	14.278	***	par_2	Significant
Language Barrier (C5)	<---	Constraint2	1.000					Significant
Health Hazards (C7)	<---	Constraint2	.954	.077	12.425	***	par_4	Significant
OER Learning Suitability (M1)	<---	Motivators2	.854	.058	14.851	***	par_8	Significant
OER Makes Learning Easy (M2)	<---	Motivators2	.891	.060	14.894	***	par_9	Significant
OER Quality Standards(M8)	<---	Motivators2	.980	.071	13.891	***	par_10	Significant

Path			Estimate	S.E.	C.R.	P	Label	Remarks
OER Improves Academic Performance (M4)	<---	Motivators2	1.000					
OER Provides Wide Literature (M7)	<---	Motivators2	.926	.081	11.497	***	par_11	Significant
OER Saves Money (M5)	<---	Motivators1	.972	.068	14.238	***	par_14	Significant
OER Promotes Collaboration (M10)	<---	Motivators1	.843	.065	12.877	***	par_15	Significant
OER Reliable Contents(M3)	<---	Motivators1	.843	.064	13.089	***	par_16	Significant
Subject Related Resources (C6)	<---	Constraints1	.929	.063	14.774	***	par_17	Significant
Interest in OER (C2)	<---	Constraints1	1.0	.065	15.845	***	par_19	Significant

Source: Researcher's Calculations based on Primary Data.

As shown in **Table 5.44** above the paths are not significant at 0.05% level of significance for some paths. These insignificant paths include; Motivators1<---Constraints1; Motivators2<---Constraint2; Motivators2<---Constraints1, and Motivators1<---Constraint2. The strategists must focus attention on these relations to improve motivation and reduce impact of the barriers. The remaining motivators and constraints load significantly on their constructs explaining their weightage in terms of regression weights. The loadings are explained as follows:

5.7.4.1 Financial Factor (Motivation 1) : It has loadings in the order of OER Reduces Photocopy Cost (1.0); OER Saves Money (0.972); OER Usability (0.885) OER Promotes Collaboration (0.843); and OER Reliable Contents (0.843). The loadings are the indicators of their importance to motivate respondents for OER. The important Motivators identified in this include financial factors. Majority of respondents believe that availability of OERs saves the money spent on textbooks and reduces the photocopying costs.

5.7.4.2 Academic Factor (Motivation 2) : It has loading in the order of OER Improves Academic Performance (1.0); OER Quality Standards (0.980); OER Provides Wide Literature (0.926); OER Makes Learning Easy (0.891); and OER Learning Suitability (0.854). The majority of respondents revealed use of OERs has significantly improved their academic performance; OERs have provided them access to wide academic literature that has made learning easy and suits to their learning styles. These are the significant motivators that have encouraged respondents to use OERs.

5.7.4.3 Constraints1 (Individual Factor) : In this construct the four constraints load in the order of-Interest in OER (1.0); Time to Find OER (1.0); Subject Related Resources (.929); and Institutional Support (.903). The greatest individual barriers identified were: lack of interest in OER, Lack of time to find related OERs followed by scattered subject related resources, and lack of encouragement and infrastructure support from the institution.

5.7.4.4 Constraint2 (Other Factors) : In this construct are two variables load namely -Language Barrier (1.0), and Health Hazards (.954) The other important barriers identified include non-availability of OERs in the native language of respondents and other health hazards.

5.8 Objective V: ROLE OF LIBRARIANS IN PROVIDING AND PROMOTING OER

In this section the major emphasis is on the study of the problems faced by faculty, UG students, PG students, and Research Scholars in accessing OER and Expectations

of users for role to be played by librarians in providing OERs. These are discussed and explained with the help of statistical analysis and testing in the succeeding sections.

5.8.1 Problems faced by Users in using Open Educational Resources

In this section an attempt has been made to explore various problems faced by Faculty, UG students, PG students, and Research Scholars. The responses statistics has been shown in **Table 5.45** below:

Table 5.45: Problems faced in using open educational resources

Statistical measure		Internet Speed	ICT Skills	Scattered Resources	Training	Searching Relevant OER	Bugs and Viruses	Compatibility with System to Open	Power Supply
N	Valid	710	710	710	710	710	710	710	710
	Missing	0	0	0	0	0	0	0	0
Mean		2.3268	1.7408	2.3211	2.1254	2.0211	2.2845	2.0310	1.6732
Std. Error of Mean		.03482	.03533	.03489	.03642	.03623	.03534	.03690	.03482
Std. Deviation		.92771	.94138	.92967	.97054	.96532	.94154	.98316	.92771
Variance		.861	.886	.864	.942	.932	.887	.967	.861
Skewness		-.693	.537	-.679	-.253	-.042	-.594	-.062	.693
Std. Error of Skewness		.092	.092	.092	.092	.092	.092	.092	.092
Kurtosis		-1.480	-1.658	-1.499	-1.894	-1.929	-1.609	-1.966	-1.480
Std. Error of Kurtosis		.183	.183	.183	.183	.183	.183	.183	.183
Range		2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Minimum		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Maximum		3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00

Source: Researcher's Calculations based on Primary Data

The following hypotheses were designed and tested to explore the problems faced by faculty, UG students, PG students, and Research Scholars

H_{05}: There is no statistically significant difference in responses regarding problems faced in accessing OERs

H_{05}: μ1 = μ2 = μ3= μ4

Ha_5 : μ1 ≠μ2 ≠μ3 ≠μ4

In this analysis an attempt has been made to know the statistical difference in means of responses of faculty (**μ1**), UG students (**μ2**), PG students (**μ3**) and research scholars (**μ4**). The results of ANOVA are shown in **Table 5.46**.

Table 5.46 : Analysis of Variance (ANOVA) of problems faced by respondents in using OERs

Problem Description		Sum of Squares	df	Mean Square	F(Sig.)/Remarks
Internet Speed	Between Groups (Combined)	8.766	3	2.922	3.430(.017) **Significant Difference**
	Within Groups	601.425	706	0.852	
	Total	610.192	709		
ICT Skills	Between Groups (Combined)	3.222	3	1.074	1.213(.304) No Significant Difference
	Within Groups	625.094	706	.885	
	Total	628.315	709		
Scattered Resources	Between Groups (Combined)	6.440	3	2.147	2.500 (.05) **Significant Difference**
	Within Groups	606.343	706	.859	
	Total	612.783	709		
Training	Between Groups (Combined)	.716	3	.239	0.253 (.860) No Significant Difference
	Within Groups	667.128	706	.945	
	Total	667.844	709		

Problem Description		Sum of Squares	df	Mean Square	F(Sig.)/Remarks
Searching Relevant OER	Between Groups (Combined)	26.437	3	8.812	9.809 (.000) **Significant Difference**
	Within Groups	634.246	706	.898	
	Total	660.683	709		
Bugs and Viruses	Between Groups (Combined)	3.812	3	1.271	1.436 (.231) No Significant Difference
	Within Groups	624.717	706	.885	
	Total	628.530	709		
Compatibility with System to Open	Between Groups (Combined)	4.348	3	1.449	1.502 (.213) No Significant Difference
	Within Groups	680.971	706	.965	
	Total	685.318	709		
Power Supply	Between Groups (Combined)	4.927	3	1.642	1.916 (.126) No Significant Difference
	Within Groups	605.264	706	.857	
	Total	610.192	709		

Source: Researcher's Calculations based on Primary Data

The above **Table 5.46** shows no statistically significant difference in responses in case of problems like-ICT Skills, Training, Bugs and Viruses, Compatibility with System to Open, and Power Supply faced by respondents in using OERs, resulting in the acceptance *of* Ho_5. However, there was a statistically significant difference in mean of responses collected from respondents in case of problems like-***Internet speed***, ***Scattered Resources, and Searching Relevant OER***. Hence, null hypothesis (Ho_5) was rejected in case of internet speed, Scattered Resources, and Searching Relevant OER problem. Therefore, an alternate hypothesis (Ha) was accepted for these variables. A Post Hoc Test was applied to further explore (Ha) the difference as in responses as shown in **Tables 5.47, 5.48 and 5.49**.

Table 5.47 : Post Hoc (Tukey HSD) Test of multiple comparison regarding internet speed and ICT skills among faculty, researchers, PG and UG students

Problems	(I) Category	(J) Category	Mean Difference (I-J)	Std. Error	Sig.	Statistically Significant Difference (Y/N)
Internet Speed	Faculty	UG students	.04466	.10946	.977	No
		PG students	.04733	.09438	.959	
		Research Scholar	-.22963	.10540	.130	
	UG students	Faculty	-.04466	.10946	.977	No
		PG students	.00267	.09723	1.00	
		Research Scholar	-.27429	.10796	**.05**	**Yes**
	PG students	Faculty	-.04733	.09438	.959	No
		UG students	-.00267	.09723	1.00	
		Research Scholar	-.27696*	.09264	**.015**	**Yes**
	Research Scholar	Faculty	.22963	.10540	.130	No
		UG students	.27429	.10796	**.055**	**Yes**
		PG students	.27696*	.09264	**.015**	**Yes**
ICT Skills	Faculty	UG students	-.11177	.11159	.748	No
		PG students	-.11445	.09622	.634	
		Research Scholar	-.20457	.10745	.227	
	UG students	Faculty	.11177	.11159	.748	No
		PG students	-.00267	.09913	1.0	
		Research Scholar	-.09280	.11006	.834	
	PG students	Faculty	.11445	.09622	.634	No
		UG students	.00267	.09913	1.0	
		Research Scholar	-.09012	.09445	.775	
	Research Scholar	Faculty	.20457	.10745	.227	No
		UG students	.09280	.11006	.834	
		PG students	.09012	.09445	.775	

Source: Researcher's Calculations based on Primary Data

The above **Table 5.47** shows the results of Post Hoc (Tukey HSD) multiple comparison test. This test is widely used for comparing multiple groups to test hypotheses using ANOVA (Hair et al., 2010). The Post Hoc (Tukey HSD) test results of "**Internet speed**" problem are as discussed below:

The comparison of **Faculty** with other respondents revealed that there was no statistically significant difference as the value (Significance level) was more than 0.05 (95% level of significance). It means that the differences in mean of responses collected from Faculty with UG students; PG students; and Research Scholars were statistically insignificant (Significance level>0.05). Hence, **Ho** was accepted.

The comparison of **UG students** with other respondents found no statistically significant difference in mean for Faculty and PG students resulting in acceptance of Ho. On the other side when UG students were compared with Research Scholars, there was a statistical significance difference (≤0.05), resulting acceptance of **Ha**.

The comparison of **PG students'** responses found that Ho was accepted for comparing with Faculty and PG students. While comparison of PG students with Research Scholars found statistically significant difference resulting in rejection of Ho and acceptance of **Ha**.

In comparing **Research Scholars** responses, it was found that Ho was accepted for comparing with Faculty. However, while in comparison between UG students and PG students, there was a statistically significant difference resulting in rejection of Ho and acceptance of **Ha**.

Hence, it is concluded that 'Internet Speed' requirements for Research Scholars are higher as compared with mean responses of Faculty (0.22963), UG Students (0.27429), and PG Students (0.27696). Results also show that there was no statistically significant difference for 'ICT Skills" problem among Faculty, PG students, UG Students and Research Scholars, resulting in acceptance of Ho and rejection of Ha.

Table 5.48: Post Hoc (Tukey HSD) Test of multiple comparison regarding Scattered Resources and Training among faculty, researchers, PG and UG students

Problems	(I) Category	(J) Category	Mean Difference (I-J)	Std. Error	Sig.	Statistically Significant Difference (Y/N)
Scattered Resources	Faculty	UG students	.07086	.10990	.917	No
		PG students	.09212	.09477	.765	
		Research Scholar	-.15177	.10583	.478	
	UG students	Faculty	-.07086	.10990	.917	No
		PG students	.02126	.09763	.996	
		Research Scholar	-.22264	.10840	.170	
	PG students	Faculty	-.09212	.09477	.765	No
		UG students	-.02126	.09763	.996	
		Research Scholar	-.24390*	.09302	**.044**	**Yes**
	Research Scholar	Faculty	.15177	.10583	.478	No
		UG students	.22264	.10840	.170	
		PG students	.24390*	.09302	**.044**	**Yes**
Training	Faculty	UG students	-.03647	.11528	.989	No
		PG students	-.06475	.09940	.915	
		Research Scholar	-.09073	.11101	.846	
	UG students	Faculty	.03647	.11528	.989	No
		PG students	-.02828	.10241	.993	
		Research Scholar	-.05426	.11370	.964	
	PG students	Faculty	.06475	.09940	.915	No
		UG students	.02828	.10241	.993	
		Research Scholar	-.02598	.09757	.993	
	Research Scholar	Faculty	.09073	.11101	.846	No
		UG students	.05426	.11370	.964	
		PG students	.02598	.09757	.993	

Source: Researcher's Calculations based on Primary Data

The above **Table 5.48** shows the results of Post Hoc (Tukey HSD) multiple comparison test. The Post Hoc (Tukey HSD) test results of "**Scattered Resources**" problem are as discussed below:

The comparison of **Faculty** with UG students, PG students and Research Scholars showed no statistically significant difference in mean of responses. Hence, **Ho5** was accepted.

The comparison of **UG students** with Faculty, PG students, and Research Scholars found no statistically significant difference in mean, resulting acceptance of **Ho5**.

When **PG students** were compared with Faculty, UG students, and Research Scholars, a statistically significant difference was found with Research Scholars. Resulting in acceptance of **Ha5**. However, **Ho5** was accepted while comparing PG students with Faculty and UG students.

The comparisons among **Research Scholars** with Faculty, UG students, and PG students revealed no statistically significant difference in means for "Scattered Resources" problem with Faculty and UG students accepting Ho. However, when compared with PG students there was a statistically significant difference in responses, resulting in rejection of Ho and acceptance of Ha. It was also found that there was no statistically significant difference among Faculty, UG students, PG students, and Research Scholars regarding 'Training', hence Ho was accepted. Therefore, it is concluded that Research Scholars have significantly different views as compared to PG students regarding the problem of scattered resources.

Table 5.49: Post Hoc (Tukey HSD) Test of multiple comparison regarding Searching Relevant OER and Bugs and Viruses among faculty, researchers, PG and UG students

Post HOC Test (Multiple Comparisons)						
Problems	**(I) Category**	**(J) Category**	**Mean Difference (I-J)**	**Std. Error**	**Sig.**	**Statistically Significant Difference (Y/N)**
Searching Relevant OER	**Faculty**	UG students	-.18728	.11241	.343	No
		PG students	-.14969	.09692	.411	
		Research Scholar	-.55539*	.10824	.000	**Yes**
	UG students	Faculty	.18728	.11241	.343	No
		PG students	.03759	.09985	.982	
		Research Scholar	-.36811*	.11087	.005	**Yes**
	PG students	Faculty	.14969	.09692	.411	No
		UG students	-.03759	.09985	.982	
		Research Scholar	-.40570*	.09513	.000	**Yes**
	Research Scholar	**Faculty**	.55539*	.10824	.000	**Yes**
		UG students	.36811*	.11087	.005	
		PG students	.40570*	.09513	.000	
Bugs and Viruses	Faculty	UG students	.04496	.11156	.978	No
		PG students	.09494	.09619	.757	
		Research Scholar	.21128	.10742	.202	
	UG students	Faculty	-.04496	.11156	.978	No
		PG students	.04998	.09910	.958	
		Research Scholar	.16633	.11003	.431	
	PG students	Faculty	-.09494	.09619	.757	No
		UG students	-.04998	.09910	.958	
		Research Scholar	.11634	.09442	.607	
	Research Scholar	Faculty	-.21128	.10742	.202	No
		UG students	-.16633	.11003	.431	
		PG students	-.11634	.09442	.607	

Source: Researcher's Calculations based on Primary Data

The above **Table 5.49** shows the results of Post Hoc (Tukey HSD) multiple comparison test. The Post Hoc (Tukey HSD) test results for "**Searching Relevant OER**" problem are as discussed below:

The comparison of **Faculty** with UG students and PG students showed no statistically significant difference in mean of responses. Hence, Ho was accepted. However, there was statistical difference of opinions between Faculty and Research scholars resulting in acceptance of Ha.

The comparison of **UG students** with Faculty and PG students showed no statistically significant difference in mean, resulting acceptance of Ho. But there was statistical difference of opinion between UG students and Research Scholars resulting in acceptance of Ha.

When **PG students** were compared with Faculty and UG students, there was a statistically significant difference resulting in acceptance of Ho. However, Ha was accepted while comparing PG students with Research Scholars.

The comparisons among **Research Scholars** with Faculty, UG students, and PG students revealed statistically significant difference in means for "**Searching Relevant OER**" problem. Hence, Ha was accepted for this group wise comparison. It was also found that there was no statistically significant difference among Faculty, UG students, PG students, and Research Scholars regarding 'Bugs and Viruses ', here Ho was accepted. Hence, it is concluded that Research Scholars have significantly different views as compared to PG students regarding 'Searching for Relevant OER'.

Table 5.50 : Post Hoc (Tukey HSD) Test of multiple comparison regarding Compatibility with System to Open and Power Supply among faculty, researchers, PG and UG students

Post HOC Test (Multiple Comparisons)						
Problems	**(I) Category**	**(J) Category**	**Mean Difference (I-J)**	**Std. Error**	**Sig.**	**Statistically Significant Difference (Y/N)**
Compatibility with System to Open	Faculty	UG students	-.16112	.11647	.510	No
		PG students	.03823	.10043	.981	
		Research Scholar	-.09532	.11215	.830	
	UG students	Faculty	.16112	.11647	.510	No
		PG students	.19936	.10346	.218	
		Research Scholar	.06580	.11488	.940	
	PG students	Faculty	-.03823	.10043	.981	No
		UG students	-.19936	.10346	.218	
		Research Scholar	-.13355	.09858	.528	
	Research Scholar	Faculty	.09532	.11215	.830	No
		UG students	-.06580	.11488	.940	
		PG students	.13355	.09858	.528	
Power Supply	Faculty	UG students	-.17089	.10981	.404	No
		PG students	-.19576	.09468	.165	
		Research Scholar	-.04422	.10573	.975	
	UG students	Faculty	.17089	.10981	.404	No
		PG students	-.02487	.09754	.994	
		Research Scholar	.12668	.10830	.646	
	PG students	Faculty	.19576	.09468	.165	No
		UG students	.02487	.09754	.994	
		Research Scholar	.15154	.09294	.362	
	Research Scholar	Faculty	.04422	.10573	.975	No
		UG students	-.12668	.10830	.646	
		PG students	-.15154	.09294	.362	
*. The mean difference is significant at the 0.05 level.						

Source: Researcher's Calculations based on Primary Data

The above **Table 5.50** shows the results of Post Hoc (Tukey HSD) multiple comparison test. The Post Hoc (Tukey HSD) test results for "**Compatibility with System to Open**" and "**Power Supply"** problem are as discussed below:

It was also found that there was no statistically significant difference among Faculty, UG students, PG students, and Research Scholars regarding "**Compatibility with System to Open**" and "**Power Supply"**, here Ho was accepted for both of these problems.

5.8.2 Role of Librarians in providing Open Educational Resources

The Skewness and Kurtosis statistics regarding role of librarians in providing OER is shown in **Table 5.51** below:

Table 5.51 : Statistics of Skewness and Kurtosis for role of librarians in providing open education resources

Statistics								
		Regular OER Updates Available	Training Programs by Library	Subject wise Library Website Listing	On Demand OER Availability	Copy Right Policies & Guidelines	OER Promotional Activities	Infrastructure of Accessing OER
N	Valid	710	710	710	710	710	710	710
	Missing	0	0	0	0	0	0	0
Mean		2.7901	2.7437	2.6169	2.7676	2.7577	2.7606	2.6310
Std. Error of Mean		.02051	.02414	.02874	.02293	.02343	.02339	.02831
Std. Deviation		.54647	.64323	.76580	.61097	.62430	.62313	.75422
Variance		.299	.414	.586	.373	.390	.388	.569
Skewness		-2.523	-2.224	-1.569	-2.391	-2.320	-2.341	-1.628
Std. Error of Skewness		.092	.092	.092	.092	.092	.092	.092
Kurtosis		5.046	3.138	.557	3.977	3.613	3.699	.752
Std. Error of Kurtosis		.183	.183	.183	.183	.183	.183	.183
Range		2.00	2.00	2.00	2.00	2.00	2.00	2.00
Minimum		1.00	1.00	1.00	1.00	1.00	1.00	1.00
Maximum		3.00	3.00	3.00	3.00	3.00	3.00	3.00
Sample Description=710 (Faculty=149, UG=136, PG=267, Research Scholar=158)								

Source: Researcher's Calculations based on Primary Data

Table 5.51 above shows lack of Skewness and Kurtosis, hence parametric test can be applied (Hair et al., 2010). In this section the following hypotheses were tested and concluded.

H_{06}: There is no statistically significant difference in responses regarding role of librarians in handling problems

H_{06}: μ1 = μ2 = μ3= μ4

H_{a6}: μ1 ≠μ2 ≠μ3 ≠μ4

In this analysis an attempt was made to know the statistical difference in means of responses among faculty (**μ1**), UG students (**μ2**), PG students (**μ3**) and researchers (**μ4**). The results of Homogeneity of Variances (Levene Statistic) for role of librarians in providing open education resources are show statistically significant difference of responses by Faculty, UG students, PG students, and Research Scholars. Levene Statistic is quick test to check homogeneity. If values for level of significance and less than 0.05, directly Post Hoc test shall be applied as shown in Table below (Hair et al., 2010). The results of Levene Statistics are shown in **Table 5.52**.

Table 5.52: Test of Homogeneity of (Variances Levene) Statistic for role of librarians in providing open education resources

Role of librarians	Levene Statistic	df1	df2	Sig.	Statistically Significant Difference (Y/N)
Regular OER Updates Available	1.682	3	706	.169	No
Training Programs by Library	18.436	3	706	.000	Yes
Subject wise Library Website Listing	64.269	3	706	.000	Yes
On Demand OER Availability	4.097	3	706	.007	Yes
Copy Right Policies & Guidelines	11.046	3	706	.000	Yes
OER Promotional Activities	16.063	3	706	.000	Yes
Infrastructure of Accessing OER	7.152	3	706	.000	Yes

Source: Researcher's Calculations based on Primary Data

The Post Hock test was applied and results are shown in the following **Tables 5.53 & 5.54 & 5.55**.

Table 5.53: Post Hock (Tukey HSD) Test of multiple comparison regarding Regular OER Updates Available, and Training Programs by Library among faculty, researchers, PG and UG students

Role of librarian	(I) Category	(J) Category	Mean Difference (I-J)	Sig.	Remarks (Ho/Ha)
Regular OER Updates Available	Faculty	UG students	.01253	.997	Ho6 Accepted
		PG students	.02041	.983	
		Research Scholar	-.03717	.934	
	UG students	Faculty	-.01253	.997	Ho6 Accepted
		PG students	.00788	.999	
		Research Scholar	-.04970	.865	
	PG students	Faculty	-.02041	.983	Ho6 Accepted
		UG students	-.00788	.999	
		Research Scholar	-.05758	.721	
	Research Scholar	Faculty	.03717	.934	Ho6 Accepted
		UG students	.04970	.865	
		PG students	.05758	.721	
Training Programs by Library	**Faculty**	UG students	.14326	.233	Ho6 Accepted
		PG students	**.23048***	**.003**	**Ha6 Accepted**
		Research Scholar	.12641	.308	Ho6 Accepted
	UG students	Faculty	-.14326	.233	
		PG students	.08722	.566	
		Research Scholar	-.01685	.996	
	PG students	**Faculty**	-.23048*	**.003**	**Ha6 Accepted**
		UG students	-.08722	.566	Ho6 Accepted
		Research Scholar	-.10406	.366	
	Research Scholar	Faculty	-.12641	.308	Ho6 Accepted
		UG students	.01685	.996	
		PG students	.10406	.366	
*. The mean difference is significant at the 0.05 level.					

Source: Researcher's Calculations based on Primary Data

The above **Table 5.53** shows that there was statistically significant difference in responses regarding ***Training Programs organised by the Library*** for Faculty and PG students. There was no statistically significant difference in responses regarding ***Regular OER Updates Available*** for Faculty, UG students, PG students, and Research Scholars.

Table 5.54: Post Hoc (Tukey HSD) Test of multiple comparison regarding Subject wise Library Website Listing, and On Demand OER Availability by Library among faculty, researchers, PG and UG students

Role of librarian	(I) Category	(J) Category	Mean Difference (I-J)	Sig.	Remarks (Ho/Ha)
Subject wise Library Website Listing	**Faculty**	**UG students**	.30285*	**.004**	**Ha Accepted**
		PG students	.13478	.291	Ho Accepted
		Research Scholar	-.21455	.058	Ho Accepted
	UG students	**Faculty**	-.30285*	**.004**	**Ha Accepted**
		PG students	-.16807	.143	Ho Accepted
		Research Scholar	-.51741*	**.000**	**Ho Accepted**
	PG students	Faculty	-.13478	.291	Ho Accepted
		UG students	.16807	.143	Ho Accepted
		Research Scholar	**-.34933***	**.000**	**Ho Accepted**
	Research Scholar	Faculty	.21455	.058	Ho Accepted
		UG students	**.51741***	**.000**	**Ho Accepted**
		PG students	**.34933***	**.000**	**Ho Accepted**

Role of librarian	(I) Category	(J) Category	Mean Difference (I-J)	Sig.	Remarks (Ho/Ha)
On Demand OER Availability	Faculty	UG students	.08671	.629	Ho Accepted
		PG students	.02494	.978	Ho Accepted
		Research Scholar	-.03755	.950	Ho Accepted
	UG students	Faculty	-.08671	.629	Ho Accepted
		PG students	-.06177	.772	Ho Accepted
		Research Scholar	-.12426	.304	Ho Accepted
	PG students	Faculty	-.02494	.978	Ho Accepted
		UG students	.06177	.772	Ho Accepted
		Research Scholar	-.06249	.738	Ho Accepted
	Research Scholar	Faculty	.03755	.950	Ho Accepted
		UG students	.12426	.304	Ho Accepted
		PG students	.06249	.738	Ho Accepted
*. The mean difference is significant at the 0.05 level.					

Source: Researcher's Calculations based on Primary Data

The above **Table 5.54** shows that there was a statistically significant difference in responses regarding ***Subject wise Library Website Listing*** for Faculty and UG students; UG students and Research Scholars, and Research Scholars and PG students. Here, Ha was accepted and Ho was accepted for Faculty comparison with UG students and PG students. There was no statistically significant difference in responses regarding ***On Demand OER Availability*** for Faculty, UG students, PG students, and Research Scholars.

Table 5.55 : Post Hoc (Tukey HSD) Test of multiple comparison regarding Subject wise Library Website Listing, and On Demand OER Availability by Library among faculty, researchers, PG and UG students

Role of librarian	(I) Category	(J) Category	Mean Difference (I-J)	Sig.	Remarks (Ho/Ha)
Copy Right Policies & Guidelines	**Faculty**	**UG students**	**.20401***	**.030**	**Ha Accepted**
		PG students	.12045	.232	Ho Accepted
		Research Scholar	.10628	.441	Ho Accepted
	UG students	**Faculty**	**-.20401***	**.030**	**Ha Accepted**
		PG students	-.08355	.579	Ho Accepted
		Research Scholar	-.09773	.536	Ho Accepted
	PG students	Faculty	-.12045	.232	Ho Accepted
		UG students	.08355	.579	Ho Accepted
		Research Scholar	-.01418	.996	Ho Accepted
	Research Scholar	Faculty	-.10628	.441	Ho Accepted
		UG students	.09773	.536	Ho Accepted
		PG students	.01418	.996	Ho Accepted
OER Promotional Activities	**Faculty**	**UG students**	**.25548***	**.003**	**Ha Accepted**
		PG students	.10922	.311	Ho Accepted
		Research Scholar	.06830	.769	Ho Accepted
	UG students	**Faculty**	**-.25548***	**.003**	**Ha Accepted**
		PG students	-.14626	.113	Ho Accepted
		Research Scholar	**-.18717***	**.049**	**Ha Accepted**
	PG students	Faculty	-.10922	.311	Ho Accepted
		UG students	.14626	.113	Ho Accepted
		Research Scholar	-.04091	.912	Ho Accepted
	Research Scholar	Faculty	-.06830	.769	Ho Accepted
		UG students	**.18717***	**.049**	**Ha Accepted**
		PG students	.04091	.912	Ho Accepted

Role of librarian	(I) Category	(J) Category	Mean Difference (I-J)	Sig.	Remarks (Ho/Ha)
Infrastructure of Accessing OER	Faculty	UG students	.06119	.903	Ho Accepted
		PG students	-.05734	.879	Ho Accepted
		Research Scholar	-.13724	.381	Ho Accepted
	UG students	Faculty	-.06119	.903	Ho Accepted
		PG students	-.11853	.441	Ho Accepted
		Research Scholar	-.19844	.110	Ho Accepted
	PG students	Faculty	.05734	.879	Ho Accepted
		UG students	.11853	.441	Ho Accepted
		Research Scholar	-.07991	.715	Ho Accepted
	Research Scholar	Faculty	.13724	.381	Ho Accepted
		UG students	.19844	.110	Ho Accepted
		PG students	.07991	.715	Ho Accepted
*. The mean difference is significant at the 0.05 level.					

Source: Researcher's Calculations based on Primary Data

The above **Table 5.55** shows that there was statistically significant difference in responses regarding ***Copy Right Policies and Guidelines*** for Faculty and UG students.

There was a statistically significant difference in responses regarding **OER Promotional Activities** when UG students were compared with Faculty and Research Scholars. Here, Ha was accepted. However, Ho was accepted while comparing Faculty with PG students and Research Scholars under 'OER Promotional Activities' role performed by librarians.

There was no statistically significant difference in responses regarding **Infrastructure of Accessing OER** for Faculty, UG students, PG students, and Research Scholars. Here, Ho was accepted for all groups.

5.8.3 Structural Relationship between Problems Faced in Accessing OERs and Roles Played by Librarians

In this section an attempt has been made to produce and test a structural model between problems faced while accessing OER and roles played by librarians to solve

them. The fit model was produced after multiple iterations. The results of a fit model indices (**Table 5.56**) showed Chi-square = 300.642, Degrees of freedom = 84, and Probability level = .000. The results of fit indices shown in Table below are acceptable (Marsh and However, 1985, Cole, 1987; Marsh, Balla& McDonald, 1988; Bentler, 1990; Hair et al., 2010).

Table 5.56: Fit indices for structural model between motivators and constraints of OER

Model	NPAR	CMIN	DF	P (≤0.05)	CMIN/DF (≤5.0)	RMR (≥0.08)	RMSEA (≥0.08)	GFI (≥0.8)	AGFI (≥0.8	NFI Delta1 (≥0.8)	TLI rho2 (≥0.8)	CFI (≥0.8)
	36	300.642	84	0.00	3.579	0.042	0.06	0.948	0.925	0.82	0.80	0.835

Source: Researcher's Calculations based on Primary Data

The regression weights of structural path and level of significance is shown in **Table 5.57** below and results for the path model are shown in **Table 5.58**.

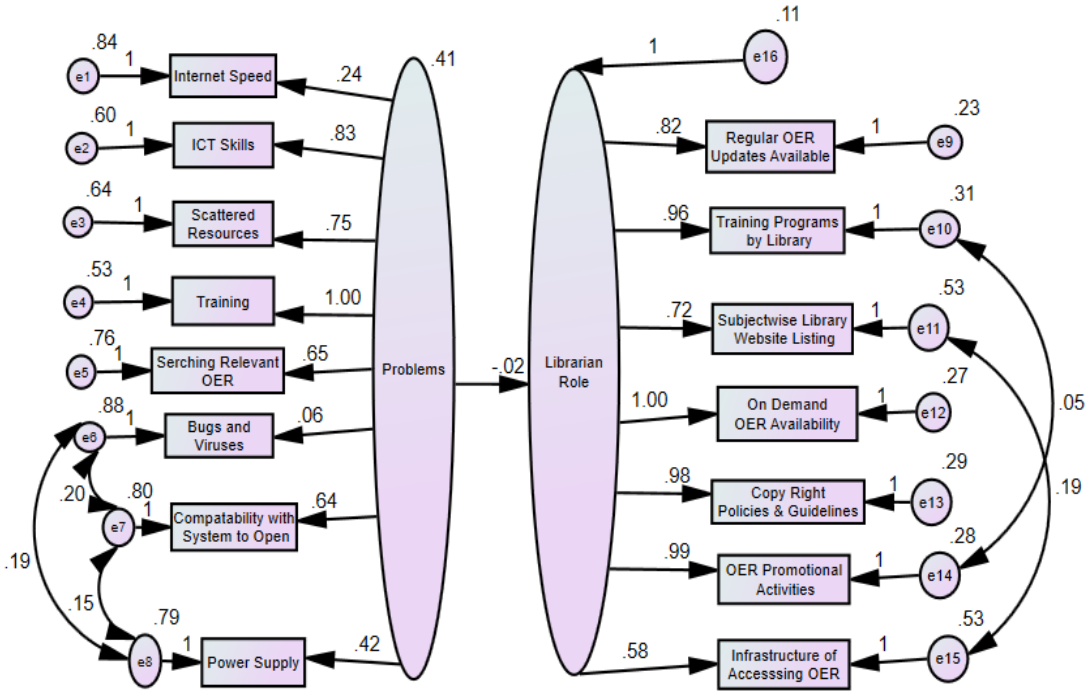

Figure 5.6: Fit structural path model between problems and role of librarian

Table 5.57: Structural path model problems and role of librarian results of motivators and constraints of OER

Path			Estimate	S.E.	C.R.	P	Label	Remarks
Librarian_Role	<---	Problems	-.024	.029	-.834	**.405**	par_6	**Not Significant**
Internet Speed (Prob1)	<---	Problems	.239	.067	3.545	***	par_1	Significant
Regular OER Updates Available (Rol1)	<---	Librarian_Role	.823	.102	8.082	***	par_2	Significant
Training Programs by Library (Rol2)	<---	Librarian_Role	.960	.125	7.666	***	par_3	Significant
Subject wise Library Website Listing (Rol3)	<---	Librarian_Role	.723	.123	5.868	***	par_4	Significant
On Demand OER Availability (Rol4)	<---	Librarian_Role	1.0					
Infrastructure of Accessing OER(Rol7)	<---	Librarian_Role	.578	.117	4.922	***	par_5	Significant
Power Supply (Prob8)	<---	Problems	.424	.071	5.941	***	par_11	Significant
ICT Skills (Prob2)	<---	Problems	.830	.084	9.854	***	par_12	Significant
Training (Prob4)	<---	Problems	1.0					
Scattered Resources (Prob3)	<---	Problems	.748	.080	9.385	***	par_13	Significant
Copy Right Policies & Guidelines (Rol5)	<---	Librarian_Role	.975	.119	8.230	***	par_14	Significant
OER Promotional Activities (Rol6)	<---	Librarian_Role	.989	.124	7.964	***	par_15	Significant
Bugs and Viruses (Prob6)	<---	Problems	.056	.069	.821	**.412**	par_17	**Not Significant**
Searching Relevant OER (Prob5)	<---	Problems	.646	.078	8.283	***	par_18	Significant
Compatibility with System to Open (Prob7)	<---	Problems	.635	.079	8.005	***	par_19	Significant

Source: Researcher's Calculations based on Primary Data

The structural path model is shown in **Fig. 5.6** and results of path analysis are shown in **Table 5.57** above. The results show insignificant path between Librarian_Role<---Problems, and Bugs and Viruses (Prob6)<---Problems. The results were further explored by producing effect estimates as shown in **Table 5.58** below:

Table 5.58: Effect estimates of structural path problems model of motivators and constraints in using OERs

Constructs and Variables	Total Effect		Direct Effect		Indirect Effect	
	Problems	Librarian_Role	Problems	Librarian_Role	Problems	Librarian_Role
Librarian_Role	-.024	.000	-.024	.000	.000	.000
Infrastructure of Accessing OER(Rol7)	-.014	.578	.000	.578	-.014	.000
OER Promotional Activities (Rol6)	-.024	.989	.000	.989	-.024	.000
Copy Right Policies & Guidelines (Rol5)	-.024	.975	.000	.975	-.024	.000
On Demand OER Availability (Rol4)	-.024	1.000	.000	1.0	-.024	.000
Subject wise Library Website Listing (Rol3)	-.018	.723	.000	.723	-.018	.000
Training Programs by Library (Rol2)	-.023	.960	.000	.960	-.023	.000
Regular OER Updates Available (Rol1)	-.020	.823	.000	.823	-.020	.000
Internet Speed (Prob1)	.239	.000	.239	.000	.000	.000
ICT Skills (Prob2)	.830	.000	.830	.000	.000	.000
Scattered Resources (Prob3)	.748	.000	.748	.000	.000	.000
Training (Prob4)	1.0	.000	1.0	.000	.000	.000
Searching Relevant OER (Prob5)	.646	.000	.646	.000	.000	.000
Bugs and Viruses (Prob6)	.056	.000	.056	.000	.000	.000
Compatibility with System to Open (Prob7)	.635	.000	.635	.000	.000	.000
Power Supply (Prob8)	.424	.000	.424	.000	.000	.000

Source: Researcher's Calculations based on Primary Data

The Total Effect (**Table 5.58)** showed that problems are negatively associated with the role of librarians. It means more problems regarding OER results negative impact on the role of librarians. However, results also revealed that roles of librarians were well presented by the variables considered in this study. All the librarian roles had well represented in the construct. The most important role based on Total Effect was On Demand OER Availability (Rol4) (1), OER Promotional Activities (Rol6) (0.989), Copy Right Policies & Guidelines (Rol5) (0.975), Training Programs by Library (Rol2) (0.96), Regular OER Updates Available (Rol1) (0.823), Subject wise Library Website Listing (Rol3) (0.723), and Infrastructure of Accessing OER(Rol7) (0.578). The results of the study reveal that majority of respondents expect that librarians should play an active role in providing and promoting OER especially in those areas where the respondents are facing problems in accessing OERs. The major areas where the extensive role of librarian is directly expected are identified as : On demand availability of OER, Promotional activities related to OER, To provide guidelines and policies related to Copyright followed by regular updates about OER. The results are in consonance with the studies by (Cakmak et al., 2012; Karadia et al., 2015; Mtumwa Mwinyimbegu, 2014)

All problems have well presented on the Problems construct. The Total Effects of various problems showed loadings in the descending order-Training (Prob4) (1), ICT Skills (Prob2) (0.83), Scattered Resources (Prob3) (0.748), Searching Relevant OER (Prob5) (0.646), Compatibility with System to Open (Prob7) (0.635), Power Supply (Prob8) (0.424), and Internet Speed (Prob1) (0.239). However, Bugs and Viruses (Prob6) (0.056) did not load significantly on the Problems construct. The basic reason for this shall be use of secure internet resources.

Summary

In this Chapter the data collected through large scale survey was analysed using various statistical techniques. The findings are depicted through tables and figures. The data was analysed objective wise and further hypotheses were also tested. Total six hypotheses were framed and results of hypotheses are shown in the succeeding chapter.

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Chapter 6

CONCLUSIONS

In this chapter the results of data analysis are summarized. The summary has been presented in the light of research objectives and testing of formulated hypothesis. It is discussed as follow:

6.1 SUMMARY OF FINDINGS AND CONCLUSIONS

The findings of the study have been discussed and presented in detail in the previous chapter of data analysis and interpretation. A brief summary of major findings is as below:

6.1.1 General Information

- The study was conducted on four central universities of North India.
- The study covered four states of North India i.e Haryana, Himachal Pradesh, Jammu and Punjab.
- Total 1100 questionnaire were sent and 790 responses were received back at response rate of 71.8%.
- Incomplete questionnaires and respondents not aware of OER were eliminated from the data and finally 710 responses were used for data analysis.
- The institution-wise responses shows that the maximum responses were received from Central University, Haryana (30.6%) followed by Central University of Jammu (25.4%), Central University of Punjab (22.3%), and Central University of Himachal Pradesh (21.8%).
- The gender-wise responses shows that the maximum responses were received from males (51.1%) followed by females (48.9%).
- The category-wise responses shows that the maximum responses were from PG students (37.6%) followed by Research Scholar (22.3%), Faculty (21.0%), UG students (19.2%) from the total responses collected of 710.

- In the age group maximum responses were received from age group (21-30) (49.0%), followed by age group (31-40) (22.8%), below 20(13.9%), age group (41-50) (12.4%), and age above 50 (1.8%).

6.1.2 Findings

The major findings of the study are as follow:

- The academic community of central universities of North India is well aware of open educational resources.
- The study reveals that a significantly large number of respondents (96.9%) are either fully or slightly aware of OERs, only 3.1% are not aware of OERs.
- It is concluded that OER awareness is higher in faculty as compared to mean responses of UG Students (0. 194), and PG Students (0.075), and Research scholars (0.229).
- The results of ICT familiarity of the respondents shows that familiarity of respondents as Excellent (22.8%), Good (54.9%), Average (20%), and Below Average (2.3%).
- The respondents were asked from which source they came to know about OERs. The results shows that Internet search was a major source of information about open educational resources followed by Teacher/Research Supervisor, Friend/Colleague, Conference, Institutional library, Self-learning, email, and other sources.
- The majority of users (60.8 %) use OERs only as and when they required them followed by 22% of respondents who use them once a week.
- The institution-wise OER awareness of respondents shows that all respondents taken in this study were aware of OER. The results showed that 50.14% respondents were slightly aware of OER and 49.86% respondents were fully aware of OER.

- The results of frequency of using OER showed that respondents have maximum response for ‘As and when required' followed by 'Once in a week', 'Once in a month', and 'once in six months'.

- The study reveals that there is no statistically significant difference in responses of faculty, UG students, PG students, and research scholars regarding the frequency of using OER.

- The results about CCL awareness of respondents shows that 52.5% respondents are slightly aware and 47.5% respondents were fully aware of CCL.

- The results showed that 97% of respondents out of 732 had full awareness, knowledge of OER and had good frequency of using OER. In this research those respondents who responded that they are 'not aware’ and had ‘never used' OERs their responses were not considered resulting effective 710 number of respondents having positive attitude towards OERs.

- The source of information about OERs showed that the 1st preference to source of information about OERs was for Internet search (35.8%), followed by Teacher/Research Supervisor (15.8%), Friend/ Colleague (14.2%), Conference (10.6%), Institutional library (8.9%), Self-learning (8.2%), email (4.2%), other sources (2.4%).

- The OER used and OER time responses revealed that the users of OER is: Never Used (1%), Occasionally Used (19.7%), and Frequently Used (79.3%).

- The respondents were asked about how much time they spend on accessing OER. The OER time-span use results have revealed: Less than an hour (28.5%), Between 1 to 2 hrs (42.1%), and more than 2 hrs (29.4%).

- The awareness regarding e-PGPathshala and NPTEL showed that only 2.5% respondents were not aware of e-PGPathshala, and only 2.39% respondents were not aware of NPTEL. Most of the respondents were aware of both the initiatives. The findings showed that awareness about NPTEL is more than e-PGPathshala.

- The findings revealed that from the various OER initiatives available at national and international level, YouTube is the most popular OER platform and is used by majority of respondents (81.3%), and as per mean value 1.8535 it is ranked 1 as the most widely used OER. It is followed by wiki sources (74.9%) respondents are aware of and have used and as per mean value 1.8648 it is ranked as 2. The responses recorded for Swayam are (52.5%), OERs provided by institution is (52.3%), NPTEL (49.0%), e-PG Pathshala (46.8%), E-Gyankosh (42.8%), and MOOCs (41.7%). In response to Not Aware about OER initiatives majority of respondents that is 65.2% were not aware about NROER (65.2%) followed by Merlot (63.7%), Connexions (56.3%), Sakshat (49.4%).

- The results also highlight that major purpose of using OERs by respondents is to prepare class notes (84.4%), followed by to get ideas and inspirations (83%), followed by to develop competencies (80.6%) and to obtain general knowledge (78.9%). The purpose of using OER was analysed both as per institution wise and as per category wise also.

- The results of structural model between the OER Extent and purpose of using OER showed positive association.

- An attempt was made to understand the preferred type of OERs by the respondents. The results showed revealed that open Audio/videos are more important to all categories of respondents as per mean value 4.57, it is followed by open e-books as second preferred OERs as per mean value 4.52, followed by open access journals as per mean value 4.21, followed by open courses as per mean value 4.18, followed by mean 3.78 for open conference proceedings, then followed by open case studies as per mean 3.75 and the least preferred OERs are Open Blogs as per 3.65 total mean value.

- Open blogs are the least preferred type of resource for most of the respondents.

- The results also showed that OER constructs significantly contribute to overall awareness of OERs. The Total Effects of various OER showed total effects as

MOOCS (0.239), e-PG Pathshala (0.264), OER Awareness (0.326), OER Knowledge (0.366), CCL Awareness (0.521), Wiki Sources (0.213), Youtube (0.212), Khan Academy (0.407), NPTEL (0.320), SWAYAM (0.113), MIT (0.515), OER by Institutions (0.368), e-Gyankosh (0.350), Connexions (0.663), MERLOT (0.663), Sakshat (0.610), and NROER (0.716) showed positive association between these variables and Overall OER Awareness.

- The results of structural model showed that:

  Institutional National OERs construct showed that e-Gyankosh is more important in imparting OERs as compared to OERs by institutions.

  i) Among the non-governmental National OERs Khan Academy showed the highest contribution.

  ii) Non-Governmental International OER construct showed equal contribution of YouTube and Wiki sources.

  iii) OERs construct showed that Non-Governmental National OER contribute higher to OERs as compared to Non-Governmental International OER.

  iv) Majority of respondents believe that availability of OERs saves the money spent on textbooks and reduces the photocopying costs.

  v) The majority of respondents revealed use of OERs has significantly improved their academic performance; OERs have provided them access to wide academic literature that has made learning easy and suits to their learning styles. These are the significant motivators that have encouraged respondents to use OERs.

  vi) The results showed that the faculty have similar experiences regarding internet speed related problems as that of UG students, PG students, and Research Scholars.

  vii) The UG students, PG students have common views regarding internet speed. The views of Research Scholars are different from UG students and PG students.

viii) The **'Internet Speed'** requirements for Research Scholars are higher as compared with mean responses of Faculty (0.22963), UG Students (0.27429), and PG Students (0.27696).

ix) The greatest individual barriers identified were: lack of interest in OER, Lack of time to find related OERs followed by scattered subject related resources, and lack of encouragement and infrastructure support from the institution.

x) There was a statistically significant difference in responses regarding ***Training Programs by Library*** for Faculty and PG students.

xi) There was no statistically significant difference in responses regarding Regular ***OER Updates Available*** for Faculty, UG students, PG students, and Research Scholars.

xii) The results showed that there was a statistically significant difference in responses regarding ***Subject wise Library Website Listing*** for Faculty and UG students; UG students and Research Scholars, and Research Scholars and PG students.

xiii) There was a statistically significant difference in responses regarding ***Copy Right Policies and Guidelines*** for Faculty and UG students.

xiv) The other important barriers identified include non-availability of OERs in the native language of respondents and other health hazards.

- The results of the study reveal that majority of respondents expect that librarians should play an active role in providing and promoting OER especially in those areas where the respondents are facing problems in accessing OERs. The major areas where the extensive role of librarian is directly expected are identified as: On demand availability of OER, Promotional activities related to OER, to provide guidelines and policies related to Copyright followed by regular updates about OER.

6.2 TESTING OF HYPOTHESES

To achieve the main objectives of the research study, few hypotheses have been formulated and tested.

The results of the following hypotheses are as below:.

Hypotheses 1:

H_{01}: There is no significant difference between respondents regarding awareness about OER.

$$H_{01}: \mu1 = \mu2 = \mu3 = \mu4$$

To further explore the difference an attempt was made to know the statistical difference in means of responses among faculty (**μ1**), UG students (**μ2**), PG students (**μ3**) and researchers (**μ4**). Post Hoc (Tukey HSD) multiple comparison test is applied.

Table 6.1: Post Hoc (Tukey HSD) Test of Multiple Comparison regarding OER Awareness

(I) Category	(J) Category	Mean Difference (I-J)	Std. Error	Sig.	Remarks
Faculty	**UG students**	.194*	.066	**.017**	**H_0 Rejected**
	PG students	.075	.056	.551	**H_0** Accepted
	Research Scholar	.229*	.063	**.002**	**H_0 Rejected**
UG students	**Faculty**	-.194*	.066	.017	**H_0 Rejected**
	PG students	-.120	.058	.169	H0 Accepted
	Research Scholar	.035	.065	.948	H0 Accepted
PG students	Faculty	-.075	.056	.551	H0 Accepted
	UG students	.120	.058	.169	H0 Accepted
	Research Scholar	.155*	.055	**.027**	**H_0 Rejected**

(I) Category	(J) Category	Mean Difference (I-J)	Std. Error	Sig.	Remarks
Research Scholar	Faculty	-.229*	.063	**.002**	**H_0 Rejected**
	UG students	-.035	.065	.948	H0 Accepted
	PG students	-.155*	.055	**.027**	**H_0 Rejected**
*. The mean difference is significant at the 0.05 level.					

The comparison of **Faculty** with PG students revealed that there was no statistical significance difference as the value (Significance level) was more than 0.05 (95% level of significance) accepting H0. However, the comparison of **Faculty** with UG students and Research Scholars shows statistically significant (Significance level>0.05). Hence, **H_{01}** was rejected. The comparison of **UG students** with PG students and Research Scholars, has revealed no statistical significance difference in mean resulting acceptance of Ho. On the other side when UG students were compared with Faculty, there was a statistical significance difference (≤0.05), resulting rejection of **H_{01}**.

The comparison of PG students' responses found that Ho was accepted for comparing with Faculty and UG students. While comparison of PG students with Research Scholars found statistically significant difference resulting rejection of **H_{01}**. In comparing **Research Scholars** responses, it was found that Ho was accepted for mean difference significance level of Faculty and UG students. However, while comparison PG students, there was a statistically significant difference resulting rejection of **H_{01}**. Hence, it is concluded that **OER awareness are** higher for faculty as compared with mean responses of UG Students (0. 194), and PG Students (0.075), and Research scholars (0.229).

Hypotheses 2:

The following hypotheses was formulated for the study.

H_{02}: **There is no significant difference between respondents regarding frequency of using OERs.**

Table 6.2 : Category wise Frequency of using open educational resources by respondents in central universities of North India

Frequency of Using OER	Users Category				Total	Chi –Square (χ^2)
	Faculty	UG students	PG students	Research Scholar		
Once in a week	34	22	63	37	156 (22%)	$x^2 = 16.259$ $df = 9$ $p = .062$
Once in a month	16	20	26	9	71 (10%)	
As and when required	94	81	162	95	432 (60.8%)	
Never used	5	13	16	17	51 (7.2%)	
Total	**149**	**136**	**267**	**158**	**710**	

Table 6.2 reveals that the frequency of using OERs for majority of respondents that is 432 (60.8%) is primarily need based as they use OERs only as and when they are required. The frequency of using OER for 156 (22%) respondents are once in a week, 71 (10%) use them once in a month and 51 (7.2%) had never used OERs. The Chi-square value of $x^2 = 16.259$, $df = 9$, and $p = .062$. Shows that the level of significance is more than 0.05 hence, there is no statistically significance difference in responses of faculty, UG students, PG students, and Research Scholars regarding frequency of using OER. Here, **H_{02}** is accepted.

Hypotheses 3:

In this section an attempt has been made to test the following hypothesis using SEM:

H_{03}: There is significant relationship between various constructs of OERs and Overall OERs Awareness.

An attempt has been made to understand the structural relationship between awareness construct and various constructs of OER. The reliability and validity of scale is tested with the help of SPSS 26.0 software. The results of scale rated on 3-point Likert scale (1=Not at all Aware, 2=Slightly Aware, 3=Fully Aware).

Table 6.3: Level of significance of structural paths between OERs and awareness

Structural Relations			Estimate	S.E.	C.R.	P	Label	Sig.
OERs	<---	Overall_OER_Awareness	1.098	.127	8.620	***	par_5	Yes
Repositories	<---	Overall_OER_Awareness	2.420	.196	12.342	***	par_6	Yes
Coursewares	<---	Overall_OER_Awareness	1.670	.164	10.207	***	par_7	Yes
Repositories_National	<---	Repositories	1.000					
Courseware_National	<---	Coursewares	.512	.072	7.073	***	par_3	Yes
Courseware_International	<---	Coursewares	1.000					
Non_Governmental_National_OER	<---	OERs	1.000					
Institutional_National_OER	<---	Overall_OER_Awareness	1.017	.133	7.658	***	par_4	Yes
Non_Governmental_International_OER	<---	OERs	.386	.082	4.710	***	par_11	Yes
Repositories_International	<---	Repositories	.954	.062	15.425	***	par_12	Yes
Wikisources (OER18)	<---	Non_Governmental_International_OER	.986	.034	29.116	***	par_1	Yes
Khan Academy (OER19)	<---	Non_Governmental_National_OER	1.000					
CCL Awareness (OER3)	<---	Overall_OER_Awareness	1.000					
e-PG Pathshala (OER8)	<---	Repositories_National	.300	.047	6.357	***	par_2	Yes

Structural Relations			**Estimate**	**S.E.**	**C.R.**	**P**	**Label**	**Sig.**
OER Knowledge (OER2)	<---	Overall_OER_Awareness	.889	.093	9.533	***	par_8	Yes
OER Awareness (OER1)	<---	Overall_OER_Awareness	.698	.082	8.550	***	par_9	Yes
YouTube (OER16)	<---	Non_Governmental_International_OER	1.000					
OER by Institutions (OER17)	<---	Institutional_National_OER	.959	.146	6.548	***	par_10	Yes
e-Gyankosh (OER11)	<---	Institutional_National_OER	1.000					
Sakshat (OER10)	<---	Repositories_National	.844	.059	14.305	***	par_13	Yes
NROER (OER12)	<---	Repositories_National	1.000					
MERLOT (OER20)	<---	Repositories_International	.902	.062	14.564	***	par_14	Yes
Connexions (OER14)	<---	Repositories_International	1.000					
NPTEL (OER9)	<---	Courseware_National	1.000					
Swayam (OER21)	<---	Courseware_National	.349	.134	2.611	.009	par_15	Yes
MIT (OER15)	<---	Courseware_International	1.000					
MOOCS (OER13)	<---	Courseware_International	.419	.076	5.485	***	par_16	Yes

Note : H_{03}: There is significant relationship between various constructs of OER and Overall OER Awareness is accepted

As shown in **Table 6.3** that all structural paths are significant at 0.05 level resulting acceptance of H_{03}. The contribution of all OER towards overall awareness is revealed by calculating effect estimates.

The results also showed that these constructs significantly contribute to overall awareness of OERs. The Total Effects of various OER showed Table 6.4 total effects as MOOCS (0.239), e-PG Pathshala (0.264), OER Awareness (0.326), OER Knowledge (0.366), CCL Awareness (0.521), Wikisources (0.213), Youtube (0.212), Khan Academy (0.407), NPTEL (0.320), SWAYAM (0.113), MIT (0.515), OER by Institutions (0.368), e-Gyankosh (0.350), Connexions (0.663), MERLOT (0.663),Sakshat (0.610), and NROER (0.716) showed positive association between these variables and Overall OER Awareness.

Table 6.4 : Standardized effect estimates of awareness and open educational resources

Constructs/ Variables	Overall_OER_Awareness		
	Total Effect	**Direct Effect**	**Indirect Effect**
	Overall_OER_ Awareness	**Overall_OER_A wareness**	**Overall_OER_A wareness**
OERs	1.000	1.000	.000
Coursewares	1.000	1.000	.000
Repositories	1.000	1.000	.000
Repositories_International	1.000	.000	1.000
Institutional_National_OER	1.000	1.000	.000
Courseware_International	1.000	.000	1.000
Courseware_National	1.000	.000	1.000
Repositories_National	1.000	.000	1.000
Non_Governmental_National_OER	1.000	.000	1.000
Non_Governmental_International_OER	1.000	.000	1.000

Constructs/ Variables	Overall_OER_Awareness		
	Total Effect	Direct Effect	Indirect Effect
	Overall_OER_ Awareness	Overall_OER_A wareness	Overall_OER_A wareness
MOOCS (OER13)	.239	.000	.239
e-PG Pathshala (OER8)	.264	.000	.264
OER Awareness (OER1)	.326	.326	.000
OER Knowledge (OER2)	.366	.366	.000
CCL Awareness (OER3)	.521	.521	.000
Wikisources (OER18)	.213	.000	.213
YouTube (OER16)	.212	.000	.212
Khan Academy (OER19)	.407	.000	.407
NPTEL (OER9)	.320	.000	.320
Swayam (OER21)	.113	.000	.113
MIT (OER15)	.515	.000	.515
OER by Institutions (OER17)	.368	.000	.368
e-Gyankosh (OER11)	.350	.000	.350
Connexions (OER14)	.663	.000	.663
MERLOT (OER20)	.663	.000	.663
Sakshat (OER10)	.610	.000	.610
NROER (OER12)	.716	.000	.716

Hypotheses 4:

The basic purposes of using OER was revealed with the help of strong literature support in consultation of practitioners and researchers. In this section the following hypothesis was tested:

H_{04}: There is a significant relation between OER_Purpose and OER_Extent

Table 6.5: Results of proposed path model between purpose and extent of OER

Structural Path			Estimate	S.E.	C.R.	P	Label	Remarks
OER_Purpose	**<---**	**OER_Extent**	.154	.035	4.380	***	par_3	Significant
P7	<---	OER_Purpose	.248	.197	1.255	.209	par_1	**Not Significant**
OER6	<---	OER_Extent	.980	.014	68.443	***	par_2	Significant
P1	<---	OER_Purpose	.796	.297	2.680	.007	par_4	Significant
P2	<---	OER_Purpose	.056	.184	.303	.762	par_5	**Not Significant**
P3	<---	OER_Purpose	1.000					
P4	<---	OER_Purpose	.310	.214	1.445	.148	par_6	**Not Significant**
P5	<---	OER_Purpose	.682	.274	2.490	.013	par_7	Significant
P6	<---	OER_Purpose	.811	.297	2.735	.006	par_8	Significant
P8	<---	OER_Purpose	.538	.231	2.328	.020	par_9	Significant
OER5	<---	OER_Extent	.546	.028	19.161	***	par_10	Significant
OER2	<---	OER_Extent	1.000					
OER1	<---	OER_Extent	.539	.027	19.885	***	par_11	Significant
H_{04}: There is a significant relation between OER_Purpose and OER_Extent is accepted								

The results of **Table 6.5** revealed the insignificant relations for "OER Frequency Inspirations (P7)<---OER_Purpose construct, Prepare Class Notes (P2)<---OER_Purpose construct, and General Knowledge (P4)<---OER_Purpose construct. However, there was significant relation between **OER_Purpose<---OER_Extent** resulting acceptance of H_{04}.

Hypotheses 5:

The following hypotheses were designed and tested to explore the problems faced by faculty, UG students, PG students, and Research Scholars

H_{05}: There is no statistically significant difference in responses regarding problems faced in accessing OERs

H_{05}: μ1 = μ2 = μ3= μ4

Ha_5 : μ1 ≠μ2 ≠μ3 ≠μ4

In this analysis an attempt has been made to know the statistical difference in means of responses of faculty (**μ1**), UG students (**μ2**), PG students (**μ3**) and research scholars (**μ4**). The results of ANOVA are shown in **Table 6.5**.

Table 6.6: Analysis of Variance (ANOVA) of problems faced by respondents in using OERs

Problem Description		**Sum of Squares**	**df**	**Mean Square**	**F(Sig.)/Remarks**
Internet Speed	Between Groups (Combined)	8.766	3	2.922	3.430 (.017) **Significant Difference**
	Within Groups	601.425	706	0.852	
	Total	610.192	709		
ICT Skills	Between Groups (Combined)	3.222	3	1.074	1.213 (.304) No Significant Difference
	Within Groups	625.094	706	.885	
	Total	628.315	709		
Scattered Resources	Between Groups (Combined)	6.440	3	2.147	2.500 (.05) **Significant Difference**
	Within Groups	606.343	706	.859	
	Total	612.783	709		
Training	Between Groups (Combined)	.716	3	.239	0.253 (.860) No Significant Difference
	Within Groups	667.128	706	.945	
	Total	667.844	709		

Problem Description		Sum of Squares	df	Mean Square	F(Sig.)/Remarks
Searching Relevant OER	Between Groups (Combined)	26.437	3	8.812	9.809 (.000) **Significant Difference**
	Within Groups	634.246	706	.898	
	Total	660.683	709		
Bugs and Viruses	Between Groups (Combined)	3.812	3	1.271	1.436 (.231) No Significant Difference
	Within Groups	624.717	706	.885	
	Total	628.530	709		
Compatibility with System to Open	Between Groups (Combined)	4.348	3	1.449	1.502 (.213) No Significant Difference
	Within Groups	680.971	706	.965	
	Total	685.318	709		
Power Supply	Between Groups (Combined)	4.927	3	1.642	1.916 (.126) No Significant Difference
	Within Groups	605.264	706	.857	
	Total	610.192	709		

The above **Table 6.6** shows no statistically significant difference in responses in case of problems like-ICT Skills, Training, Bugs and Viruses, Compatibility with System to Open, and Power Supply faced by respondents in using OERs, resulting in the acceptance *of* Ho_5. However, there was a statistically significant difference in mean of responses collected from respondents in case of problems like-***Internet speed***, ***Scattered Resources, and Searching Relevant OER***. Hence, null hypothesis (Ho_5) was rejected in case of internet speed, Scattered Resources, and Searching Relevant OER problem. Therefore, an alternate hypothesis (Ha) was accepted for these variables. A Post Hoc Test was applied to further explore (Ha) the difference as in responses as shown in **Tables 6.7, 6.8 and 6.9**.

Table 6.7: Post Hoc (Tukey HSD) Test of multiple comparison regarding internet speed and ICT skills among faculty, researchers, PG and UG students

Problems	(I) Category	(J) Category	Mean Difference (I-J)	Std. Error	Sig.	Statistically Significant Difference (Y/N)
Internet Speed	**Faculty**	UG students	.04466	.10946	.977	No
		PG students	.04733	.09438	.959	
		Research Scholar	-.22963	.10540	.130	
	UG students	Faculty	-.04466	.10946	.977	No
		PG students	.00267	.09723	1.00	
		Research Scholar	-.27429	.10796	**.05**	**Yes**
	PG students	Faculty	-.04733	.09438	.959	No
		UG students	-.00267	.09723	1.00	
		Research Scholar	-.27696*	.09264	**.015**	**Yes**
	Research Scholar	Faculty	.22963	.10540	.130	No
		UG students	.27429	.10796	**.055**	**Yes**
		PG students	.27696*	.09264	**.015**	**Yes**
ICT Skills	**Faculty**	UG students	-.11177	.11159	.748	No
		PG students	-.11445	.09622	.634	
		Research Scholar	-.20457	.10745	.227	
	UG students	Faculty	.11177	.11159	.748	No
		PG students	-.00267	.09913	1.0	
		Research Scholar	-.09280	.11006	.834	
	PG students	Faculty	.11445	.09622	.634	No
		UG students	.00267	.09913	1.0	
		Research Scholar	-.09012	.09445	.775	
	Research Scholar	Faculty	.20457	.10745	.227	No
		UG students	.09280	.11006	.834	
		PG students	.09012	.09445	.775	

The above **Table 6.7** shows the results of Post Hoc (Tukey HSD) multiple comparison test. This test is widely used for comparing multiple groups to test hypotheses using ANOVA. The Post Hoc (Tukey HSD) test results of "**Internet speed**" problem are as discussed below:

The comparison of **Faculty** with other respondents revealed that there was no statistically significant difference as the value (Significance level) was more than 0.05 (95% level of significance). It means that the differences in mean of responses collected from Faculty with UG students; PG students; and Research Scholars were statistically insignificant (Significance level>0.05). Hence, **Ho** was accepted.

The comparison of **UG students** with other respondents found no statistically significant difference in mean for Faculty and PG students resulting in acceptance of Ho. On the other side when UG students were compared with Research Scholars, there was a statistical significance difference (≤0.05), resulting acceptance of **Ha**.

The comparison of **PG students'** responses found that Ho was accepted for comparing with Faculty and PG students. While comparison of PG students with Research Scholars found statistically significant difference resulting in rejection of Ho and acceptance of **Ha**.

In comparing **Research Scholars** responses, it was found that Ho was accepted for comparing with Faculty. However, while in comparison between UG students and PG students, there was a statistically significant difference resulting in rejection of Ho and acceptance of **Ha**.

Hence, it is concluded that 'Internet Speed' requirements for Research Scholars are higher as compared with mean responses of Faculty (0.22963), UG Students (0.27429), and PG Students (0.27696). Results also show that there was no statistically significant difference for 'ICT Skills" problem among Faculty, PG students, UG Students and Research Scholars, resulting in acceptance of Ho and rejection of Ha.

Table 6.8 : Post Hoc (Tukey HSD) Test of multiple comparison regarding Scattered Resources and Training among faculty, researchers, PG and UG students

Problems	(I) Category	(J) Category	Mean Difference (I-J)	Std. Error	Sig.	Statistically Significant Difference (Y/N)
Scattered Resources	Faculty	UG students	.07086	.10990	.917	No
		PG students	.09212	.09477	.765	
		Research Scholar	-.15177	.10583	.478	
	UG students	Faculty	-.07086	.10990	.917	No
		PG students	.02126	.09763	.996	
		Research Scholar	-.22264	.10840	.170	
	PG students	Faculty	-.09212	.09477	.765	No
		UG students	-.02126	.09763	.996	
		Research Scholar	-.24390*	.09302	**.044**	**Yes**
	Research Scholar	Faculty	.15177	.10583	.478	No
		UG students	.22264	.10840	.170	
		PG students	.24390*	.09302	**.044**	**Yes**
Training	Faculty	UG students	-.03647	.11528	.989	No
		PG students	-.06475	.09940	.915	
		Research Scholar	-.09073	.11101	.846	
	UG students	Faculty	.03647	.11528	.989	No
		PG students	-.02828	.10241	.993	
		Research Scholar	-.05426	.11370	.964	
	PG students	Faculty	.06475	.09940	.915	No
		UG students	.02828	.10241	.993	
		Research Scholar	-.02598	.09757	.993	
	Research Scholar	Faculty	.09073	.11101	.846	No
		UG students	.05426	.11370	.964	
		PG students	.02598	.09757	.993	

The above **Table 6.8** shows the results of Post Hoc (Tukey HSD) multiple comparison test. The Post Hoc (Tukey HSD) test results of "**Scattered Resources**" problem are as discussed below:

The comparison of **Faculty** with UG students, PG students and Research Scholars showed no statistically significant difference in mean of responses. Hence, **Ho5** was accepted.

The comparison of **UG students** with Faculty, PG students, and Research Scholars found no statistically significant difference in mean, resulting acceptance of **Ho5**.

When **PG students** were compared with Faculty, UG students, and Research Scholars, a statistically significant difference was found with Research Scholars. Resulting in acceptance of **Ha5**. However, **Ho5** was accepted while comparing PG students with Faculty and UG students.

The comparisons among **Research Scholars** with Faculty, UG students, and PG students revealed no statistically significant difference in means for "Scattered Resources" problem with Faculty and UG students accepting Ho. However, when compared with PG students there was a statistically significant difference in responses, resulting in rejection of Ho and acceptance of Ha. It was also found that there was no statistically significant difference among Faculty, UG students, PG students, and Research Scholars regarding 'Training', hence Ho was accepted. Therefore, it is concluded that Research Scholars have significantly different views as compared to PG students regarding the problem of scattered resources.

Table 6.9: Post Hoc (Tukey HSD) Test of multiple comparison regarding Searching Relevant OER and Bugs and Viruses among faculty, researchers, PG and UG students

Post HOC Test (Multiple Comparisons)						
Problems	**(I) Category**	**(J) Category**	**Mean Difference (I-J)**	**Std. Error**	**Sig.**	**Statistically Significant Difference (Y/N)**
Searching Relevant OER	**Faculty**	UG students	-.18728	.11241	.343	No
		PG students	-.14969	.09692	.411	
		Research Scholar	-.55539*	.10824	.000	**Yes**
	UG students	Faculty	.18728	.11241	.343	No
		PG students	.03759	.09985	.982	
		Research Scholar	-.36811*	.11087	.005	**Yes**
	PG students	Faculty	.14969	.09692	.411	No
		UG students	-.03759	.09985	.982	
		Research Scholar	-.40570*	.09513	.000	**Yes**
	Research Scholar	**Faculty**	.55539*	.10824	.000	**Yes**
		UG students	.36811*	.11087	.005	
		PG students	.40570*	.09513	.000	
Bugs and Viruses	Faculty	UG students	.04496	.11156	.978	No
		PG students	.09494	.09619	.757	
		Research Scholar	.21128	.10742	.202	
	UG students	Faculty	-.04496	.11156	.978	No
		PG students	.04998	.09910	.958	
		Research Scholar	.16633	.11003	.431	
	PG students	Faculty	-.09494	.09619	.757	No
		UG students	-.04998	.09910	.958	
		Research Scholar	.11634	.09442	.607	
	Research Scholar	Faculty	-.21128	.10742	.202	No
		UG students	-.16633	.11003	.431	
		PG students	-.11634	.09442	.607	

The above **Table 6.9** shows the results of Post Hoc (Tukey HSD) multiple comparison test. The Post Hoc (Tukey HSD) test results for "**Searching Relevant OER**" problem are as discussed below:

The comparison of **Faculty** with UG students and PG students showed no statistically significant difference in mean of responses. Hence, Ho was accepted. However, there was statistical difference of opinions between Faculty and Research scholars resulting in acceptance of Ha.

The comparison of **UG students** with Faculty and PG students showed no statistically significant difference in mean, resulting acceptance of Ho. But there was statistical difference of opinion between UG students and Research Scholars resulting in acceptance of Ha.

When **PG students** were compared with Faculty and UG students, there was a statistically significant difference resulting in acceptance of Ho. However, Ha was accepted while comparing PG students with Research Scholars.

The comparisons among **Research Scholars** with Faculty, UG students, and PG students revealed statistically significant difference in means for "**Searching Relevant OER**" problem. Hence, Ha was accepted for this group wise comparison. It was also found that there was no statistically significant difference among Faculty, UG students, PG students, and Research Scholars regarding 'Bugs and Viruses ', here Ho was accepted. Hence, it is concluded that Research Scholars have significantly different views as compared to PG students regarding 'Searching for Relevant OER'.

Table 6.10: Post Hoc (Tukey HSD) Test of multiple comparison regarding Compatibility with System to Open and Power Supply among faculty, researchers, PG and UG students

Post HOC Test (Multiple Comparisons)						
Problems	**(I) Category**	**(J) Category**	**Mean Difference (I-J)**	**Std. Error**	**Sig.**	**Statistically Significant Difference (Y/N)**
Compatibility with System to Open	Faculty	UG students	-.16112	.11647	.510	No
		PG students	.03823	.10043	.981	
		Research Scholar	-.09532	.11215	.830	
	UG students	Faculty	.16112	.11647	.510	No
		PG students	.19936	.10346	.218	
		Research Scholar	.06580	.11488	.940	
	PG students	Faculty	-.03823	.10043	.981	No
		UG students	-.19936	.10346	.218	
		Research Scholar	-.13355	.09858	.528	
	Research Scholar	Faculty	.09532	.11215	.830	No
		UG students	-.06580	.11488	.940	
		PG students	.13355	.09858	.528	
Power Supply	Faculty	UG students	-.17089	.10981	.404	No
		PG students	-.19576	.09468	.165	
		Research Scholar	-.04422	.10573	.975	
	UG students	Faculty	.17089	.10981	.404	No
		PG students	-.02487	.09754	.994	
		Research Scholar	.12668	.10830	.646	
	PG students	Faculty	.19576	.09468	.165	No
		UG students	.02487	.09754	.994	
		Research Scholar	.15154	.09294	.362	
	Research Scholar	Faculty	.04422	.10573	.975	No
		UG students	-.12668	.10830	.646	
		PG students	-.15154	.09294	.362	
*. The mean difference is significant at the 0.05 level.						

The above **Table 6.10** shows the results of Post Hoc (Tukey HSD) multiple comparison test. The Post Hoc (Tukey HSD) test results for "**Compatibility with System to Open**" and "**Power supply"** problem are as discussed below:

It was also found that there was no statistically significant difference among Faculty, UG students, PG students, and Research Scholars regarding "**Compatibility with System to Open**" and "**Power Supply"**, here Ho was accepted for both of these problems.

Hypotheses 6 :

In this section the following hypotheses were tested and concluded.

H_{06}: There is no statistically significant difference in responses regarding role of librarians in handling problems

$$H_{06}: \mu1 = \mu2 = \mu3 = \mu4$$

$$H_{a6}: \mu1 \neq \mu2 \neq \mu3 \neq \mu4$$

In this analysis an attempt was made to know the statistical difference in means of responses among faculty (**μ1**), UG students (**μ2**), PG students (**μ3**) and researchers (**μ4**). The results of Homogeneity of Variances (Levene Statistic) for role of librarians in providing open education resources are show statistically significant difference of responses by Faculty, UG students, PG students, and Research Scholars. Levene Statistic is quick test to check homogeneity. If values for level of significance and less than 0.05, directly Post Hoc test shall be applied as shown in Table below (Hair et al., 2010). The results of Levene Statistics are shown in **Table 6.11**.

Table 6.11 : Test of Homogeneity of (Variances Levene) Statistic for role of librarians in providing open education resources

Role of librarians	Levene Statistic	df1	df2	Sig.	Statistically Significant Difference (Y/N)
Regular OER Updates Available	1.682	3	706	.169	No
Training Programs by Library	18.436	3	706	.000	Yes
Subject wise Library Website Listing	64.269	3	706	.000	Yes
On Demand OER Availability	4.097	3	706	.007	Yes
Copy Right Policies & Guidelines	11.046	3	706	.000	Yes
OER Promotional Activities	16.063	3	706	.000	Yes
Infrastructure of Accessing OER	7.152	3	706	.000	Yes

The Post Hock test was applied and results are shown in the following **Tables 6.12 & 6.13 & 6.14**.

Table 6.12: Post Hock (Tukey HSD) Test of multiple comparison regarding Regular OER Updates Available, and Training Programs by Library among faculty, researchers, PG and UG students

Role of librarian	(I) Category	(J) Category	Mean Difference (I-J)	Sig.	Remarks (Ho/Ha)
Regular OER Updates Available	Faculty	UG students	.01253	.997	Ho6 Accepted
		PG students	.02041	.983	
		Research Scholar	-.03717	.934	
	UG students	Faculty	-.01253	.997	Ho6 Accepted
		PG students	.00788	.999	
		Research Scholar	-.04970	.865	

Role of librarian	(I) Category	(J) Category	Mean Difference (I-J)	Sig.	Remarks (Ho/Ha)
	PG students	Faculty	-.02041	.983	Ho6 Accepted
		UG students	-.00788	.999	
		Research Scholar	-.05758	.721	
	Research Scholar	Faculty	.03717	.934	Ho6 Accepted
		UG students	.04970	.865	
		PG students	.05758	.721	
Training Programs by Library	**Faculty**	UG students	.14326	.233	Ho6 Accepted
		PG students	**.23048***	**.003**	**Ha6 Accepted**
		Research Scholar	.12641	.308	Ho6 Accepted
	UG students	Faculty	-.14326	.233	
		PG students	.08722	.566	
		Research Scholar	-.01685	.996	
	PG students	**Faculty**	-.23048*	**.003**	**Ha6 Accepted**
		UG students	-.08722	.566	Ho6 Accepted
		Research Scholar	-.10406	.366	
	Research Scholar	Faculty	-.12641	.308	Ho6 Accepted
		UG students	.01685	.996	
		PG students	.10406	.366	
*. The mean difference is significant at the 0.05 level.					

The above **Table 6.12** shows that there was statistically significant difference in responses regarding ***Training Programs organised by the Library*** for Faculty and PG students. There was no statistically significant difference in responses regarding ***Regular OER Updates Available*** for Faculty, UG students, PG students, and Research Scholars.

Table 6.13: Post Hoc (Tukey HSD) Test of multiple comparison regarding Subject wise Library Website Listing, and On Demand OER Availability by Library among faculty, researchers, PG and UG students

Role of librarian	(I) Category	(J) Category	Mean Difference (I-J)	Sig.	Remarks (Ho/Ha)
Subject wise Library Website Listing	**Faculty**	**UG students**	.30285*	**.004**	**Ha Accepted**
		PG students	.13478	.291	Ho Accepted
		Research Scholar	-.21455	.058	Ho Accepted
	UG students	**Faculty**	-.30285*	**.004**	**Ha Accepted**
		PG students	-.16807	.143	Ho Accepted
		Research Scholar	-.51741*	**.000**	**Ho Accepted**
	PG students	Faculty	-.13478	.291	Ho Accepted
		UG students	.16807	.143	Ho Accepted
		Research Scholar	**-.34933***	**.000**	**Ho Accepted**
	Research Scholar	Faculty	.21455	.058	Ho Accepted
		UG students	**.51741***	**.000**	**Ho Accepted**
		PG students	**.34933***	**.000**	**Ho Accepted**
On Demand OER Availability	Faculty	UG students	.08671	.629	Ho Accepted
		PG students	.02494	.978	Ho Accepted
		Research Scholar	-.03755	.950	Ho Accepted
	UG students	Faculty	-.08671	.629	Ho Accepted
		PG students	-.06177	.772	Ho Accepted
		Research Scholar	-.12426	.304	Ho Accepted
	PG students	Faculty	-.02494	.978	Ho Accepted
		UG students	.06177	.772	Ho Accepted
		Research Scholar	-.06249	.738	Ho Accepted
	Research Scholar	Faculty	.03755	.950	Ho Accepted
		UG students	.12426	.304	Ho Accepted
		PG students	.06249	.738	Ho Accepted
*. The mean difference is significant at the 0.05 level.					

The above **Table 6.13** shows that there was a statistically significant difference in responses regarding ***Subject wise Library Website Listing*** for Faculty and UG students; UG students and Research Scholars, and Research Scholars and PG students. Here, Ha was accepted and Ho was accepted for Faculty comparison with UG students and PG students. There was no statistically significant difference in responses regarding ***On Demand OER Availability*** for Faculty, UG students, PG students, and Research Scholars.

Table 6.14: Post Hoc (Tukey HSD) Test of Multiple Comparison regarding Subject wise Library Website Listing, and On Demand OER Availability by Library among faculty, researchers, PG and UG students

Role of librarian	**(I) Category**	**(J) Category**	**Mean Difference (I-J)**	**Sig.**	**Remarks (Ho/Ha)**
Copy Right Policies & Guidelines	**Faculty**	**UG students**	**.20401***	**.030**	**Ha Accepted**
		PG students	.12045	.232	Ho Accepted
		Research Scholar	.10628	.441	Ho Accepted
	UG students	**Faculty**	**-.20401***	**.030**	**Ha Accepted**
		PG students	-.08355	.579	Ho Accepted
		Research Scholar	-.09773	.536	Ho Accepted
	PG students	Faculty	-.12045	.232	Ho Accepted
		UG students	.08355	.579	Ho Accepted
		Research Scholar	-.01418	.996	Ho Accepted
	Research Scholar	Faculty	-.10628	.441	Ho Accepted
		UG students	.09773	.536	Ho Accepted
		PG students	.01418	.996	Ho Accepted
OER Promotional Activities	**Faculty**	**UG students**	**.25548***	**.003**	**Ha Accepted**
		PG students	.10922	.311	Ho Accepted
		Research Scholar	.06830	.769	Ho Accepted

Role of librarian	(I) Category	(J) Category	Mean Difference (I-J)	Sig.	Remarks (Ho/Ha)
	UG students	**Faculty**	**-.25548***	**.003**	**Ha Accepted**
		PG students	-.14626	.113	Ho Accepted
		Research Scholar	**-.18717***	**.049**	**Ha Accepted**
	PG students	Faculty	-.10922	.311	Ho Accepted
		UG students	.14626	.113	Ho Accepted
		Research Scholar	-.04091	.912	Ho Accepted
	Research Scholar	Faculty	-.06830	.769	Ho Accepted
		UG students	**.18717***	**.049**	**Ha Accepted**
		PG students	.04091	.912	Ho Accepted
Infrastructure of Accessing OER	Faculty	UG students	.06119	.903	Ho Accepted
		PG students	-.05734	.879	Ho Accepted
		Research Scholar	-.13724	.381	Ho Accepted
	UG students	Faculty	-.06119	.903	Ho Accepted
		PG students	-.11853	.441	Ho Accepted
		Research Scholar	-.19844	.110	Ho Accepted
	PG students	Faculty	.05734	.879	Ho Accepted
		UG students	.11853	.441	Ho Accepted
		Research Scholar	-.07991	.715	Ho Accepted
	Research Scholar	Faculty	.13724	.381	Ho Accepted
		UG students	.19844	.110	Ho Accepted
		PG students	.07991	.715	Ho Accepted
*. The mean difference is significant at the 0.05 level.					

The above **Table 6.14** shows that there was statistically significant difference in responses regarding ***Copy Right Policies and Guidelines*** for Faculty and UG students.

There was a statistically significant difference in responses regarding **OER Promotional Activities** when UG students were compared with Faculty and Research Scholars. Here, Ha was accepted. However, Ho was accepted while comparing Faculty with PG students and Research Scholars under 'OER Promotional Activities' role performed by librarians.

There was no statistically significant difference in responses regarding **Infrastructure of Accessing OER** for Faculty, UG students, PG students, and Research Scholars. Here, Ho was accepted for all groups

6.3 SUGGESTIONS

In this section the major problems faced by Faculty, UG students, PG students, and Research Scholars discussed and suggested remedies based on results of data analysis as below:

- **Internet Speed**

The requirement of Internet speed for research scholars is much higher compared to UG students (with mean difference of 0.27429) and PG students (with mean difference of 0.27696). The practitioners, policy makers and strategists need to look at the extensive needs of researchers for better research outputs.

- **ICT Skills**

The mean difference of ICT skills of Faculty with UG Students, PG Students, and Research Scholars has revealed difference of -.11177, -.11445, and -.20457. It means that the youngest generation (UG) students have low ICT Skills related problems. Hence, Faculty, PG students and Research Scholars need to upgrade their ICT skills. The strategists and policy makers need to organize training programs for both of them.

- **Scattered Resources**

The mean difference between responses of Research Scholar and that of Faculty, UG Students, and PG Students revealed the values of 0.15177, 0.22264, and **0.24390**. The practitioners and policy makers need to extensively look at the problems faced by at PG and Research level regarding scattered resource problem.

- **Training**

The views for training are same for Faculty, UG students, PG students, and Research Scholars. Hence, a uniform training strategy and policy will work for Faculty, UG students, PG students, and Research Scholars regarding 'Training'. There should be training programs for all users to make optimum use of OERs.

- **Searching Relevant OER**

The mean difference between responses of Research Scholar and that of Faculty, UG Students, and PG Students revealed the values of 0.55539, and 0.36811 and 0.40570. The practitioners and policy makers need to extensively look at the problems faced at Research Scholar level regarding Searching Relevant OER problem.

- **Bugs and Viruses**

A uniform strategy and policy to tackle 'bugs and viruses' will work for Faculty, UG students, PG students, and Research Scholars.

- **Compatibility with System to Open**

A uniform strategy and policy to tackle Compatibility with System to Open will work for Faculty, UG students, PG students, and Research Scholars.

- **Power Supply**

A uniform strategy and policy to tackle power supply related problems shall work for Faculty, UG students, PG students, and Research Scholars.

- All these problems were negatively associated with the role of librarians. It means such problems negate the role of librarians.

- The Repositories have the maximum contribution towards overall OER awareness followed by Coursewares OERs, and Institutional National OER. The National Repositories are compatible with International Repositories. The International Courseware are much better than National Courseware. The Non-Governmental National OER are much better than Non-Governmental International OER. Therefore, the strategists and policy makers need to focus on the limiting areas to OER for betterment of users.

- A uniform strategy shall work well for the group comparison where there is no statistical significance difference. It shall work well for the ***'On Demand OER Availability'*** *and '* **Infrastructure of Accessing OER**' roles of librarian to better impart OER. However, uniform strategy shall not work for ***Training Programs by Library, Regular OER Updates Available, Copy Right Policies & Guidelines,*** **and OER Promotional Activities.** Here, a need-based *strategy and policy need to be developed.*

- In this technological era, the utilization of open educational resources in academic institutions is inevitable. Most of the educational content is freely available on different websites under the open educational repositories platform.

- The findings of the present study can be useful for libraries and OER service providers in understanding the requirements and expectations of academic communities regarding OERs. The current study has revealed that maximum users have awareness about OERs and they have a favourable attitude towards OERs. This shows that the academic communities are interested to use OERs and they are well aware of their benefits. Although most of the institutions are providing free Internet/Wi-Fi facilities on their campuses still more infrastructural support may be provided to libraries for easy and efficient access and delivery of OERs.

- The findings reveal that users prefer educational content in audio/video format, the same is proved by their preference for YouTube over other OER initiatives. If we take a look at users' expectations from the libraries regarding OERs, it is clear that YouTube meets the users' expectations at large and perhaps is the main

reason for its wider popularity and usage. YouTube provides the content in audio/ video format and it also brings down all the related content in suggested videos etc. It also provides reviews and a rating system to any content through the likes, views, and comments received on particular content.

- The modern era libraries need to revive their resource dissemination techniques. The information architecture of the websites providing OER facilities needs to be strengthened. The structure of websites should bring together the scattered resources in one place as a single window search. It will make searching of particular subject-related content easy and less time-consuming. The libraries should also provide regular updates to their academic communities about the available OERs.

- The policymakers need to clearly define the copyright policies etc to increase the free utilization of these OERs. Sustainability for a longer duration is one of the biggest challenges due to which the Open Educational Resources Movement is still struggling. Frequent training programs and copyright awareness sessions are required to increase the popularity and use of OERs.

6.4 AREAS FOR FURTHER RESEARCH

The current study has shown the use and awareness of open educational resources in the four central universities of North India. The present study is limited only to central universities of North India.
Similar research may be conducted on the state universities of any region.

- Similar research can be conducted such as on PG students of humanities who are less research minded.

- Similar research may be conducted on the Research on the perception of the quality of OERs and identification of quality indicators of Indian OER content say in social sciences.

- Impact of use of OERs on the quality and productivity of faculty and Research scholars in social sciences.

- Role of Librarians in effective usage and promotion of OERs.
- Comparative study between the use of subscribed textbooks and OERs.
- It is suggested that further research in future may be conducted covering wide range of educational institutions across the country. The chances are there that reputation, accreditations, funding pattern, geographical location, and infrastructure shall also impact availability and access of OER. Also, there is a need to develop a culture of self-learning and thinking out of box to match OER offered with interest and needs of users for their better future prospects. Finally, there is a need to benchmark OER strategy to not only to gain international market share but also in the best interest of humanity across the globe.

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