

DIGITAL LEARNING INFRASTRUCTURE IN HIGHER EDUCATION: AN EMPIRICAL EVALUATION OF EDUCATIONAL RESOURCES AND REPOSITORY SERVICES

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Abstract

This empirical study which assesses utilization patterns, user experience and perceived academic impact of digital educational resources and repositories for higher education students. A descriptive and empirical research design was adopted and a structured five-points Likert scale questionnaire was presented to 60 students, out of which 50 valid responses representing 83.33% response rate were analyzed using descriptive statistics and Chi-square (χ^2) test. The outcomes are a moderate-to-high rate of utilization where the highest levels of regular utilization are found for assignments and course work with rather lower levels of regular found for projects and work pertaining to research. User perception is favorable 71.04% effectiveness score, however, challenges around off-campus access, download speed and guidance/support were noted. Hypothesis testing is confirmed in the manner that awareness has a significant impact on the usage level (6.53, $p < 0.05$) and perceived usefulness has a significant association with academic impact (10.59, $p < 0.05$). The study concludes that promoting awareness initiatives, user training and remote access mechanisms can further contribute towards increased effectiveness of digital educational resources and repositories in higher education institutions in an academic sense.

Keywords: Digital Educational Resources, Institutional Repositories, Higher Education, Student Use, User Experience, Academic Impact, Digital Learning Infrastructure, Chi-square Test.

1. INTRODUCTION

The digital transformation has significantly restructured the higher education environment by changing the modalities in which education and scholarship material is accessed and used by learners and scholars out of digital repositories and assets like e-books, multimedia learning objects, databases, and curated collections. This trend of openness and equity fits well with the open educator mentality described by UNESCO, the Open

Educational Resources (OER), which, the author suggests, include learning, teaching, and research materials in any form that are in the open domain or are published under an open license that allows no-cost access, reuse, adaptation, and redistribution (UNESCO, n.d.). National policy instruments have also preempted technology-enabled learning ecosystems in the Indian context as the means to improve access, quality and inclusiveness especially by enhancing digital infrastructure and content systems throughout the educational sector (Government of India, 2020). Digital content is becoming more and more accessible in the Indian academic e-resource environment, in a range of ways, through consortium-based library support and national-scale centralized ones. e-ShodhSindhu consortia was formed as the merger of previous consortia, namely, UGC-INFONET Digital Library Consortium, N-LIST, and INDEST-AICTE, into one framework and aimed at providing higher-education institutions with access to high-quality electronic resources (INFLIBNET Centre, n.d.). Later, the Government of India approved the One Nation One Subscription (ONOS) scheme (Union Cabinet approval on 25 November 2024). The initial step, which will start on 1 January 2025, aims to provide centralized access to over 13,000 journals to over 6,300 government institutions of higher-education and research and development, and expand scholarly coverage to a significant population of national academic community (Press Information Bureau, 2025). However, such availability of policy guidelines and platform provision does not necessarily yield an academic benefit; the real results depend on the patterns of utilization and user experience, which, in turn, depend on the awareness, accessibility, usability, and institutional or library support. In turn, an empirical assessment of digital educational resources and repositories is inalienable to produce an evidence-based set of recommendations that can be used to promote adoption and academic outcomes in higher education.

2. REVIEW OF LITERATURE

It is evidenced by numerous empirical studies that have taken various methods of study. Dr. Surveying 250 undergraduates, Varsha Agarwal et al. (2024) concluded that effective use of digital resources can significantly enhance the accessibility and usage of resources, and the latter is associated with enhanced learning effects. Monica Maiti et al. (2024) analyzed a sample of 135 study participants enrolled in a course in cloud computing and established that about 75 percent of them performed better when using digital learning techniques in comparison to traditional ones. Joseline M. Santos et al. (2025) created a Learning Materials Repository Hub and got high expert ratings in terms of content quality, teacher agreement with the usefulness of the material. Nevertheless, Victoria I. Marín et al. (2022) provided a cross-comparative study of nine countries and found that the faculty adoption has not reached the desired scale as institutional policies are still lacking and there is a shortage of professional development. Burim Mexhuani et al. (2024) have found that the digital divide, faculty resistance, and data privacy concerns were the main barriers. According to Abdhijit Chakrabarti et al. (2025), some of the issues that have been experienced included a lack of awareness about the use right and quality assurance in Indian repositories.

3. OBJECTIVES OF THE STUDY

This paper aims to assess the digital educational resources and repositories in higher education, focusing on their accessibility, use and experience by the user.

- i. To determine the patterns of utilization of digital educational resources and repositories in users in the field of higher education in terms of extent, frequency, and purpose of use by students, the faculty, and the library professionals.
- ii. To assess experience and effectiveness through study of user perceptions of usefulness, accessibility/usability, satisfaction and major constraints to successful academic implementation.
- iii. To determine the scholarly effect of digital teaching materials and depositories on educating, learning, researching and assignment creation, and to develop evidence-based suggestions of enhancement.

4. HYPOTHESIS OF THE STUDY

Due to the objectives set above, the current research will have the following hypotheses to test empirically the role of user perceptions on utilization and how utilization affects academic performance.

H¹: The perception of usefulness and ease of access/ usability play a major role in the way users utilize digital educational resources and repositories.

H²: The increased use of digital educational aids and repositories is positively related to better academic results, that is, teaching-learning assistance, research, and assignment writing.

5. SCOPE OF THE STUDY

This paper will be limited to discussing the use and efficiency of digital learning resources and digital libraries in higher learning institutions. It includes the students, faculty, and the library workers involved in the usage or organization of these resources. The scope will involve appraisal of awareness, access, usability, utilisation patterns, user satisfaction and perceived scholarly implications on teaching, learning, research and assignment work. Also, it looks into main limitations namely there is connectivity, there is access and authentication issues, there is training needs, and there is institutional/library support; and aims at making actionable and evidence-based recommendations.

6. RESEARCH METHODOLOGY

6.1 Research Design

The current research designed followed the descriptive and empirical research design with an aim of appraising the use and success of digital educational resources and

repositories in higher education. It is empirical in the sense that on the basis of the primary data gathered through a structured survey, the respondents are involved directly and descriptive in the sense that it reveals the current situation of awareness status, access, patterns of use and experience of digital resource by the users.

6.2 Study Population

The sample of the study was represented by the students of higher education, who become the main end users of the digital educational resources and also learning, assignments, and academic development repositories.

6.3 Sample Size and Sampling Technique

The questionnaires were spread among the student participants (n=60); 50 of them were presented in a complete and satisfactory form, which allowed attaining the response rate of 83.33% and formed the final sample (n=50). The choice of participants was done through proper sampling strategy, simple random sampling or convenience sampling depending on accessibility of the students to enable effective data collection within available time and resources. Moreover, there was a conscious effort to include students in various programmes and in various levels so as to make the sample well balanced.

6.4 Tool for Data Collection

A structured questionnaire was prepared on a five-point Likert scale (Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree) was employed as a primary data collection tool. The questionnaire examined aspects related to awareness, accessibility, frequency of use, purpose of use, satisfaction and perceived academic impact of digital educational resources and repositories. A pilot test was conducted to assess the clarity and relevance of the questionnaire and minor modifications were performed to enhance its reliability and appropriateness for students.

6.5 Method of Data Collection

The selected respondents, the students, were handed out the questionnaires either physically and/or in an online platform. Respondents were provided information about the study and voluntary participation was assured. To ensure honest and accurate feedback, responses were kept confidential.

6.6 Statistical Techniques

Chi-square (χ^2) test with appropriate degrees of freedom was the principal statistical procedure used to test the hypotheses and to explore relationships between key variables. Chi-square Test: Mathematically Chi-square test is represented as:

$$\chi^2 = \sum [(O_i - E_i)^2 / E_i]$$

where O denotes the observed frequency and E denotes the expected frequency of the same occurrence. The comparison between the calculated χ^2 of 2 and the table one of Chi-square at the right value of degrees of freedom (df) and chosen level of significance (e.g., 0.05) is made. Association was regarded as statistically significant in case the calculated value was higher than the table value.

Besides the Chi-square test, the summary and interpretation of the overall response of the students was summarized and represented through basic descriptive statistics including frequency, percentage, mean score, and weighted average.

6.7 Data Processing and Analysis

Responses were systematized and coded after data collection was done. The analysis of data has been conducted in terms of descriptive measurements (frequency and percentage) and interpretative measurements (mean score and weighted average). Chi-square test was used in the context of testing hypothesis and making associations whenever we needed to compare things as to their categorization. Findings came in view of tables and appropriate graphs, which could be easily understood.

6.8 Ethical Considerations

The study was conducted with ethical precautions taken. All students were involved voluntarily and the goal of the research was explained. No personalities or reactions of the participants were disclosed and only in academic and research cases.

7. DATA ANALYSIS AND INTERPRETATION

The data obtained went through coding, tabulation, and systematic analysis. The findings are indicated below with the rightful interpretation to get the main trends and findings of the research.

Table: Gender-wise Distribution of Student Respondents (n = 50)

Gender	No. of Students	Percentage (%)
Male	28	56.00
Female	22	44.00
Other / Prefer not to say	0	0.00
Total	50	100.00

As seen in Table 1, among the 50 respondents who provided valid student responses, 28 respondents (56.00) were males and 22 respondents (44.00) were females, and none of them chose other/prefer not to say. The ratio of male to female (14:11; roughly 1.27:1) suggests that the sample is somewhat more representative of male participants but the percentage of female students can still be considered high, and thus, the sample is quite balanced to be used in the analysis.

Scale: 1 = Strongly Disagree (SD), 2 = Disagree (D), 3 = Neutral (N), 4 = Agree (A), 5 = Strongly Agree (SA)

Table 2: Awareness and Utilization Pattern of Digital Educational Resources/Repositories (5-Point Scale) (n = 50)

Questions in information sources	Always	Very often	Sometimes	Rarely	Never	Standard Deviation	Responses	Weighted Average	Score
Do you access digital educational repositories/resources for your academic needs?	14 (28%)	16 (32%)	12 (24%)	6 (12%)	2 (4%)	1.13	50	2.32 / 5	134 (67%)
Do you use digital resources for preparing assignments and coursework?	15 (30%)	17 (34%)	10 (20%)	6 (12%)	2 (4%)	1.14	50	2.26 / 5	137 (68%)
Do you use digital resources for exam preparation?	12 (24%)	16 (32%)	14 (28%)	6 (12%)	2 (4%)	1.11	50	2.40 / 5	130 (65%)
Do you use digital resources for notes and lecture support?	10 (20%)	15 (30%)	15 (30%)	8 (16%)	2 (4%)	1.11	50	2.54 / 5	123 (62%)
Do you use digital resources for projects or research-related work?	9 (18%)	13 (26%)	16 (32%)	9 (18%)	3 (6%)	1.15	50	2.68 / 5	116 (58%)
Total	60 (24%)	77 (31%)	67 (27%)	35 (14%)	11 (4%)	1.13	250	2.44 / 5	640 (64.00%)
Score %	240 (24.00%)	231 (23.10%)	134 (13.40%)	35 (3.50%)	0 (0%)				640 (64.00%)

The frequency by which students access digital educational resources/repositories in various academic purposes is at Table 2. To analyze, the percentages of Always and Very often have been combined and considered as regular use. The following observations would be some of the key observations of the table:

- i. 60% of the students use digital educational repositories/resources to meet their academic requirements on a regular (28% Always + 32% Very often).

- ii. The highest regular-use indicator of the table is 64% of students usually use digital resources to prepare assignments and coursework (30 percent + 34 percent).
- iii. One-half of students use digital resources on a regular basis to prepare for exams (24% + 32%).
- iv. Half of the students use digital resources on a regular basis to get notes and lecture support (20% + 30%).
- v. Digital resources used by students to work on a project or research material are the least frequently used among all the activities (only 44% students use them regularly [18% + 26%]) but they are also used by 56% students rarely/never.

As can be seen in the table, digital educational resources are used by students more regularly when it comes to routine academic tasks (e.g. assignments, overall academic purposes, exam preparation, etc.) and relatively less often when it comes to projects/research-related work. Such a trend will suggest that the application of digital resources by students is not always motivated by long-term academic needs as investigative-focused use might need additional assistance, instructions, and training.

One can make an inference that most of the students are already active users of digital resources and enhancing the orientation and information literacy services can help in enhancing further academic usage particularly in research and project work. The total score recorded in the table is 640 (64.00%), which means that the respondents of the student group are medium to high engagements when it comes to use of digital educational materials and repositories.

Table 3: User Experience and Perceived Effectiveness (Likert Scale Summary) (Students) (n = 50)

Statements	SD	D	N	A	SA	Standard Deviation	Responses	Weighted Average	Score
Do you find digital educational resources/repositories easy to access when needed?	3 (6%)	6 (12%)	9 (18%)	20 (40%)	12 (24%)	1.14	50	3.64 / 5	182 (72.80%)
Do you find the interface/navigation of digital resources/repositories user-friendly?	2 (4%)	7 (14%)	10 (20%)	19 (38%)	12 (24%)	1.11	50	3.64 / 5	182 (72.80%)
Do you experience smooth speed while opening/downloading digital resources?	4 (8%)	9 (18%)	12 (24%)	16 (32%)	9 (18%)	1.19	50	3.34 / 5	167 (66.80%)
Do you find digital resources/repository content relevant to your academic needs?	1 (2%)	5 (10%)	8 (16%)	22 (44%)	14 (28%)	1.00	50	3.86 / 5	193 (77.20%)

Do digital resources help you save time compared to print sources?	1 (2%)	4 (8%)	9 (18%)	20 (40%)	16 (32%)	1.00	50	3.92 / 5	196 (78.40%)
Do digital resources improve the quality of your assignments/coursework?	2 (4%)	5 (10%)	11 (22%)	20 (40%)	12 (24%)	1.06	50	3.70 / 5	185 (74.00%)
Do you receive adequate guidance/support for using digital resources (library/teachers)?	5 (10%)	10 (20%)	13 (26%)	15 (30%)	7 (14%)	1.19	50	3.18 / 5	159 (63.60%)
Do you find it easy to access digital resources from outside the campus (off-campus access)?	6 (12%)	11 (22%)	14 (28%)	13 (26%)	6 (12%)	1.20	50	3.04 / 5	152 (60.80%)
Do you consider digital educational resources/repositories reliable and trustworthy?	2 (4%)	6 (12%)	12 (24%)	20 (40%)	10 (20%)	1.06	50	3.60 / 5	180 (72.00%)
Overall, are you satisfied with digital educational resources and repositories available to you?	2 (4%)	7 (14%)	11 (22%)	19 (38%)	11 (22%)	1.10	50	3.60 / 5	180 (72.00%)
Total	28 (5.60 %)	70 (14.00 %)	109 (21.80 %)	184 (36.80 %)	109 (21.80 %)	1.14	500	3.55 / 5	1776 (71.04%)
Score (%)	28 (1.12 %)	140 (5.60 %)	327 (13.08 %)	736 (29.44 %)	545 (21.80 %)				1776 (71.04%)

Table 3 presents the experience and perceived effectiveness of digital sources of education and repositories by students. As an analysis it has combined the percentages of Agree and Strongly Agree and interpreted it as a positive perception. The table is observed to have some important statements which are as follows:

1. Digital resources/repositories When prompted with whether they find it simple to access the digital resources/repositories when they need them, 64% of students said Yes (40% Agree, 24% Strongly Agree).
2. Two thirds of the students (62% of respondents) believe that the interface/navigation is user friendly (38 percent + 24 percent).
3. The percentage of the students who positively agree that they enjoy an unhindered pace of opening / downloading digital materials (32% + 18% = 50 in total) does not exceed half, which means that the problem of connectivity / speed could be a concern.
4. Relevance of content has the highest positive rating with 72 percent of students concurring that it is relevant in academic requirements (44 percent + 28 percent).
5. 72 percent of students feel that digital resources are time-saving as opposed to print sources (40 percent and 32 percent) and high functional value.
6. The percentage of students who believe that digital resources enhance the quality of the assigned task/coursework is 64 (40 percent + 24 percent).

7. Conversely, among the students, merely 44% students respond positively that they are adequately guided/supported by the library/teachers (30% + 14%), which allows revealing a support gap.
8. The level of off-campus accessibility is rather low: only 38% students can easily access off-campus resources (26% + 12%), which is indicative of an obvious access barrier beyond campus.
9. On the issue of trust, 60% students believe that digital resources/repositories are reliable and trustworthy (40% + 20%).
10. All of the satisfaction issues are moderate to high, with 60 percent of students indicating that they are satisfied with the available digital resources and repositories (38 Suddenly plus 22 per cent).

The table displays that students to a large extent find digital educational resources and repositories helpful, save money, and academically relevant, particularly, when it comes to everyday academic requirements and assignment work. Meanwhile, the reduced positive scores on download speed, guidance/support and off-campus access denote the possible operational and level one operational barriers that could inhibit successful use. We can conclude that the overall efficiency of the digital educational material in higher education can be enhanced significantly because of the technical access (connectivity and remote access) and the reinforcement of user support and orientation. The total table score was 1776 (71.04%), and this was demonstrating a fairly positive user experience and perceived effectiveness among the respondent students.

8. HYPOTHESES TESTING

The Chi-square (χ^2) test was utilized to test the stated hypotheses as well as to investigate the relationship between the chosen variables using the level of significance of 5 percent ($\alpha = 0.05$). The results of the cross-tabulation, and the values of χ^2 , degrees of freedom (df) and p-values are calculated and offered in Table 4. Whenever p is below 0.05 a hypothesis is said to be supported and otherwise, it is not dominated.

Table 4: Hypotheses Testing using Chi-square (χ^2) Test (n = 50)

Hypothesis	Variables Tested	Cross-tabulation (Observed Frequencies)	χ^2 (Calculated)	df	p-value	Decision ($\alpha=0.05$)
H1	Awareness \times Usage Level (High/Low)	Awareness (Yes): High=28, Low=13; Awareness (No): High=2, Low=7	6.53	1	0.011	Supported

H2	Perceived Usefulness × Academic Impact (High/Low)	High usefulness: High impact=28, Low impact=8; Low usefulness: High impact=4, Low impact=10	10.59	1	0.001	Supported
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Table 4 demonstrates the Chi-square test results to investigate the correlation between the two chosen variables at the level of significance 5%.

H1 (Awareness × Usage Level) the Chi-square value calculated is 6.53 with a df of 1 and $p=0.011$ that is lower than 0.05. Thus, the null hypothesis of no relationship is rejected and H1 is accepted. It goes to show that the awareness of digital educational repositories/resources significantly influences the likelihood of students to be in the high usage category demonstrating that awareness is a major contributor to utilization.

The calculated Chi-square value = 10.59 with $df = 1$ $p=0.001$, which is also not less than 0.05 is also less than H2 (Perceived Usefulness × Academic Impact). Therefore, the null hypothesis is abolished and H2 accepted. This supports the assertion that students with greater perceived usefulness on digital resources are availed much more improvements on reporting on improvement of academic impact, including quality improvement on assignment, and academic support. On the whole, the Chi-square outcomes present statistical information to support the fact that awareness and perceived usefulness are used as the determinants that affect the process of using digital educational resources/repositories and the perceived academic benefit by the student.

9. FINDINGS OF THE STUDY

The paper indicates that student respondents within the education system of higher learning are actively attending online learning materials and platforms driven by the need to undertake regular school assignments and that the experience is largely positive. Nevertheless, there is access and support related problems that restrict further academic usage. The key findings are as follows:

- i. There is a moderate balance in the gender distribution of the respondents, 56 percent of males and 44 percent of females ($n=50$).
- ii. The utilization by the students is moderate-high and the general utilization score is 640 (64.00) and a weighted mean utilization score of 2.44/5 (Table 2).
- iii. Regular use (Always + Very often) is the highest on assignments/coursework (64%), general academic needs (60%), exam preparation (56%), notes/lecture support (50%).
- iv. The lowest frequency of use is projects/research-related work (44%), so, relatively, students use research oriented weakerly.

- v. The general user experience of students is positive as the overall score of effectiveness is 1776 (71.04) and overall weighted average is 3.55/5 (Table 3).
- vi. There are high perceived academic values of digital resources and the strongest positive perceptions are connected with content relevance (72%), and time-saving benefits (72%).
- vii. The main weaknesses are reflected in off-campus access (only 38% positive), guidance/support (44% positive) and speed of downloading/opening content (50% positive), which allows making the necessary technical and service improvements.
- viii. The confirmation of the statistically significant associations is done through hypothesis testing: awareness is significantly related to the level of usage (25.53 , $p = 0.0111$) and perceived usefulness is significantly related to academic impact (210.59 , $p = 0.01010$).

10. CONCLUSION

The current paper demonstrates that student respondents in higher institutions of learning are the active users of digital learning resources and depositories in their academic pursuits. The percentage of students who access these resources with regularity is also large as well as a pretty good percentage access them to prepare coursework and assignments besides the exam preparations and more importantly to learn the subject. Nevertheless, a relatively smaller number of students display a regular use of digital resources in projects and research-based activity, which suggests that gaining advanced academic use is at an early stage. The perception of students in terms of the usefulness of digital resources especially with respect to relevance, time saving benefits, and enhancement of knowledge in terms of assignments are mostly positive thereby indicating that the digital resources are facilitating the routine learning activities of students. Meanwhile, reduced values of off-campus access and guidance/support indicate that the availability does not have enough practical impediments to serve every student fully.

It is concluded that the majority of the student respondents can use digital learning materials and repositories in their daily academic needs, and statistical testing proves it further that awareness and perceived usefulness are the keys to utilization and academic outcomes to a great extent. Consequently, orientation and user training programmes should be conducted on a regular basis, and the support to access (particularly off-campus) should be improved with the assistance of the library and the faculty to enhance the student interaction with the digital educational materials and repositories and to optimize the academic performance of digital educational resources.

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